TECHNICAL MANUAL

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OPERATOR'S, ORGANIZATIONAL DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

RADIO RECEIVER R-901/GR

(NSN 5820-000-136-4974)

HEADQUARTERS, DEPARTMENT OF THE ARMY
SEPTEMBER 1973

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DEPARTMENT OF THE ARMY
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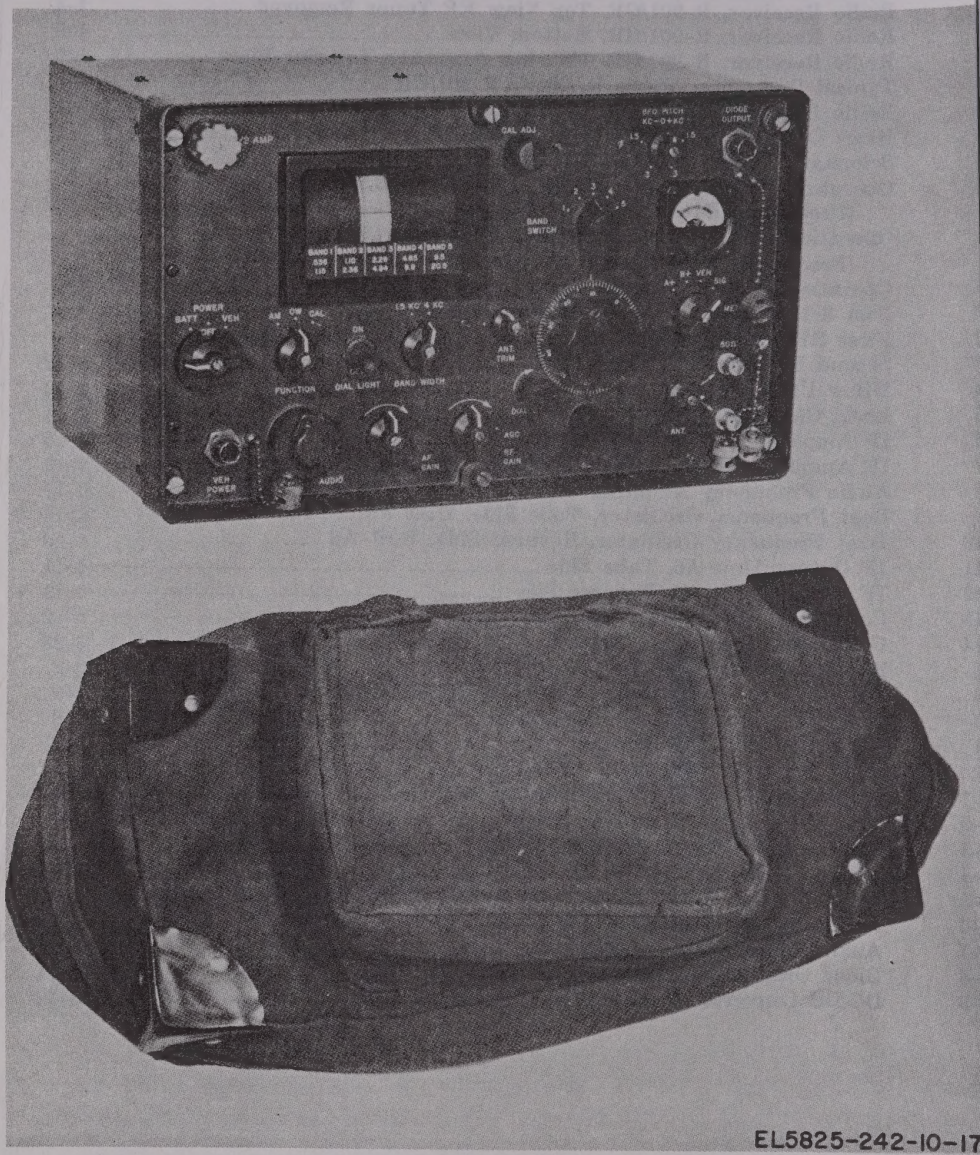

Figure 1-1. Radio Receiver R-901/GR.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual describes Radio Receiver R-901/GR (fig. 1-1), and covers its installation, operation, organizational maintenance, circuit functioning, troubleshooting, repairs and alignment, and limited storage. The manual also includes data for maintenance work at the direct support, general support and depot levels.

b. Appendix B is the maintenance allocation chart (MAC) and lists the special tools and equipment required for each maintenance level.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are Modification Work Orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFM 75-18/MCO P4610.19C, and DLAR 4500.15.

1-3.1. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-MA-Q, Fort Monmouth, NJ 07703.

1-3.2. Reporting Equipment Improvement Recommendations (EIR).

EIR's will be prepared using DA Form 2407 (Maintenance Request). Instructions for preparing EIR's are provided in TM 38-750, the Army Maintenance Management System. EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-MA-Q, Fort Monmouth, New Jersey 07703. A reply will be furnished direct to you.

Section II. DESCRIPTION AND DATA

1-4. Purpose and Use

a. Radio Receiver R-901/GR is a communications receiver designed for use as part of a direction-finding system or for monitoring and recording of transmissions in the frequency range of 0.536 to 20.5 MHz. The receiver is portable and, with the use of an auxiliary vehicular shock mount, can be mounted in vehicular system or equivalent. This receiver is capable of receiving am, cw, and modulated cw (mcw) signals throughout its frequency range.

b. All operating controls, switches, and indicators are located on the front panel. All antenna input and output connectors are also mounted on the front panel as is an auxiliary battery power connector. The receiver is capable of operating from internal batteries contained in a rear compartment or from the vehicular power supply of 24 volts fed to a connector located within the battery compartment at the rear of the receiver.

1-5. Technical Characteristics

The technical characteristics of Radio Receiver R-901/GR are as follows:

Receiver type	Superheterodyne
Number of tubes	11
Frequency range	536 MHz to 20.5 MHz
Number of bands	5
Band 1	536—1.15 MHz
2	1.10—2.36 MHz
3	2.25—4.84 MHz
4	4.65—9.9 MHz
5	9.5—20.5 MHz
Sensitivity	1 microvolt for 10 db signal + noise to noise ratio
Type of signals received	cw, mcw, am
Intermediate frequency	455 kHz
Bandwidth	Switch-selected 1.5 kHz or 4.0 kHz
Method of dial calibration	Built-in crystal controlled calibrator

Frequency checkpoints ..... Every 200 kHz from 600 kHz to 4.8 MHz; every 1 MHz from 5 MHz to 20 MHz

Power input:
- Filament, operating midpoint ..... 445 ma at 1.25 volts
- Plate, operating midpoint ..... 30 ma at 45.0 volts
- Total power consumption .2.1 watts

Power source:
- Man-pack ..... Battery: one (1) BA-403/U filament supply, one (1) BA-418/U plate supply
- Vehicular ..... 24 vdc nominal

Weight:
- Without batteries ..... 21.5 lbs
- With batteries ..... 24 lbs

Overall dimensions ..... 8¾" high x 14½" wide x 9⅛ deep

1-6. Components of Radio Receiver R-901/GR

a. Components (fig. 1-1).

Quantity	*Item*	*Height (in.)*	*Depth (in.)*	*Width (in.)*	*Unit Weigh (lbs.)*
1	Receiver, Radio R-901/GR	8¾	9⅛	14½	21.5
1	Technical Manual TM 11-5820-783-14*				

*One (1) technical manual packed with equipment. Where valid need exists, additional copies may be requisitioned an kept on hand.

b. Running Spares. No accessories, tools or test equipment are issued with the receiver. The running spares provided are listed below:

Quantity	*Item*
2	Lamp, incandescent, 331
5	Fuse, cartridge, ½ ampere, FO2A-250V½A

1-7. Description of Equipment

a. General. Radio Receiver R-901/GR is a portable, self-contained, communications receiver. The unit (fig. 1-1) is an 11-tube, 5-band, single conversion superheterodyne receiver, tunable over the frequency range of .536 to 20.5 MHz. When used as a manportable unit, the receiver operates from its own batteries contained in a compartment at the rear. When used in a vehicle or shelter, the receiver is secured to a vehicular shock mount and receives input power through a connector located at the rear of the battery compartment.

b. Inputs and Outputs. Except for the power connector at the rear, all input and output connections are made through connectors located on the front panel of the receiver. These include two input receptacles for antennas, one for a 50-ohm DF antenna and one for a conventional whip antenna, a diode output connector for direction-finding operations and an audio output connector for a 600-ohm headset. There also is an auxiliary vehicle power input receptacle for use in cases where the only power source is 24 volts. All operating controls and indicators are also on the front panel of the receiver. The headset, power cables, and diode output cables are not supplied with the receiver, but are required depending upon the intended use.

c. Construction. The receiver consists of three major portions. These are the panel and chassis assembly with plug-in modules, RF tuner assembly, and housing assembly. The RF tuner assembly is mounted on the panel and chassis assembly which in turn slides into the housing assembly from the front. When fully seated into the housing assembly (case), the front panel forms a watertight seal for field use.

1-8. Description of Major Components

a. The panel and chassis assembly (fig. 1-2), contains the operation controls, switches, indicating devices and external connectors, power distribution cables and connectors to the RF tuner assembly and two subchassis. The subchassis are frames and plates that support plug-in operating modules. The plug-ins mount into connectors set into the base chassis. The modules are the IF amplifier unit A5, IF output unit A6, calibration oscillator unit A7, variable beat frequency oscillator unit A8, and AF amplifier unit A9. Also mounted on the assembly are two mechanical IF filters (fig. 1-3) and a number of discrete components that make up the audio output stage and tuning elements associated with front panel controls.

b. The RF tuner assembly (fig. 1-2) is mounted directly on the panel and chassis assembly. The tuner assembly contains a combined three-section and one-section variable tuning capacitor, band switch, RF coil inclosures, and mechanical interconnections from the front panel. The RF tuner assembly also contains four plug-in modules: first RF amplifier, unit A1; second RF amplifier, unit A2; mixer, unit A3, and local oscillator, unit A4. The entire RF assembly is inclosed in a shield.

c. The housing assembly (fig. 1-4) contains the "A" and "B" battery compartment and the vehicular power supply, unit A10. The power supply is housed in its own inclosure secured to the inside of the housing assembly. The meter

nd power connections to the panel and chassis ssembly from the sources in the housing ssembly are through mating connectors on the assis and in the housing assembly. Insertion the chassis into the housing mates the con-ectors to the power connections to the remain-er of the receiver. The battery compartment ccess is through a watertight panel on the ear; the battery connections are on flexible rds to allow easy connection and discon-ection.

-9. Description of Accessories

a. General. Radio Receiver R-901/GR has ccessory items that are not furnished with the ceiver but are available for use with it. These ems are described below.

b. Vehicular Mounting Base MT-3670/GR. he vehicular mounting base is an aluminum ate equipped with shock mounts. In use, the ase is mounted in the vehicle or shelter and he receiver is clamped and secured on it.

c. Canvas Field Pack CW-1067/GR (figure -1). This is a zippered carrying bag that can e used for man-portable operations of the ceiver. The bag is rectangular in shape, made accommodate the receiver. The corners are ubber padded on the inside and metal rein-rced on the outside. A smaller canvas com-artment is attached to the top of the bag, this ompartment is used for carrying a headset and n extension cord.

-10. Additional Equipment Required But Not Supplied

he following equipment is not supplied as part Radio Receiver R-901/GR, but is needed for se of the receiver under the conditions noted.

a. Battery, BA403/U. This 1.5-volt battery is he primary source for filament voltage in the man-portable mode of operation. It should not be installed in vehicular operation (unless made necessary by malfunction or loss of vehicle power) to avoid damage caused by battery deterioration.

b. Battery, BA-418/U. This 45-volt battery is the source of plate voltage in the man-portable mode of operation. The same precautions concerning vehicular operation that apply to the filament voltage battery apply to this battery.

c. Vehicular Power Supply. When used in mobile operation such as a vehicle or shelter, the receiver requires a 24-volt source.

d. Headset H-113/U. A 600-ohm headset, H-113/U or equivalent, is required for audio monitoring. Headset H-113/U consists of two earphones, mounted on an adjustable headband, and a connecting cord and plug. The earphones are provided with rubber ear cushions. The cord is approximately 18 inches, extending from the right-hand earphone and has a standard phone plug terminating the cord.

e. Antennas. When used as part of a direction-finding system, a suitable DF antenna and antenna control unit are required. The DF antenna output is connected to the 50 ohm ANT receptacle on the front panel of the receiver. When used for monitoring or recording purposes, a whip-type antenna is required. The whip antenna is connected by suitable cable to the WHIP ANT receptacle on the front panel of the receiver.

f. Interconnecting Cables. Cables for connecting the DIODE OUTPUT connector of the receiver to the remainder of the DF system, for connecting the receiver to a recorder, for connecting the receiver to the external vehicular power source, etc, are required. These items are normally part of other systems to which the receiver is mated for use.

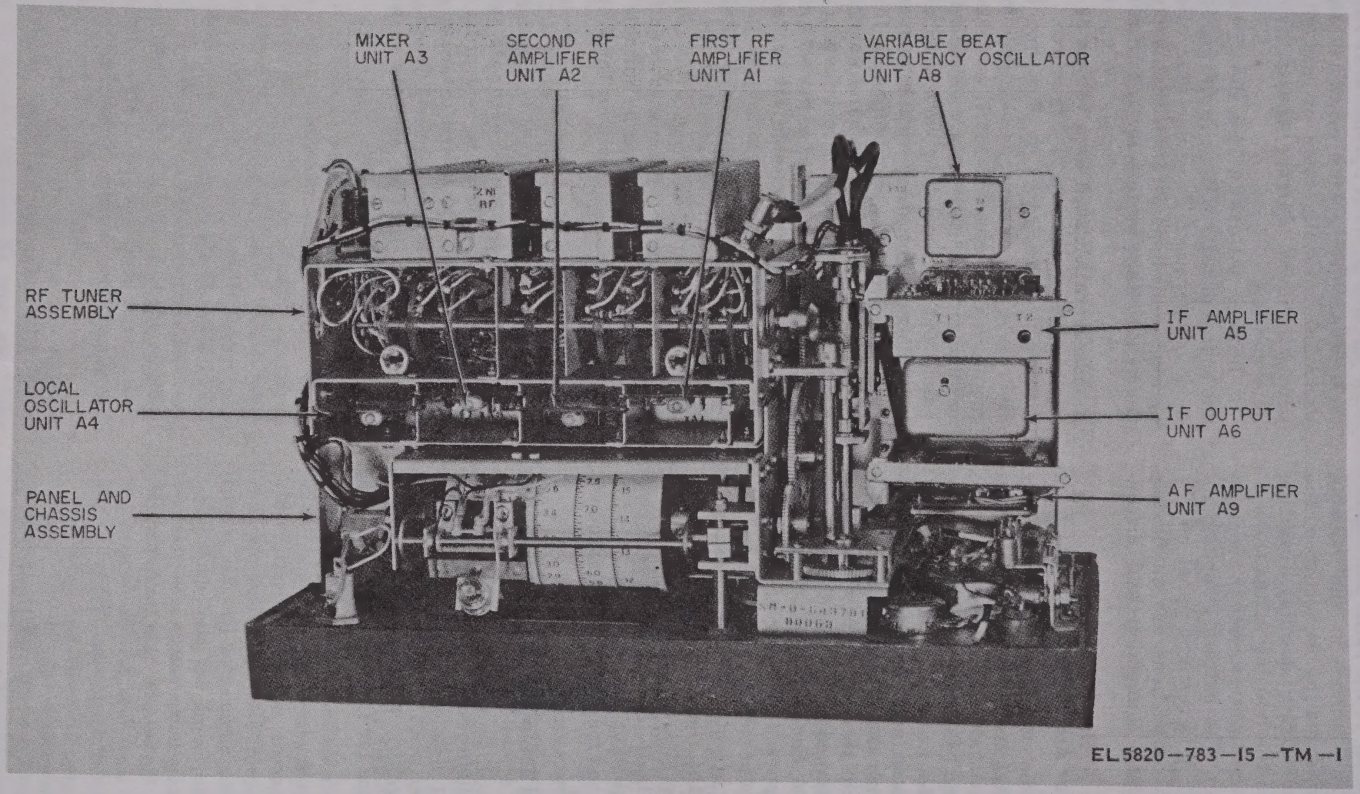
MIXER UNIT A3
SECOND RF AMPLIFIER UNIT A2
FIRST RF AMPLIFIER UNIT A1
VARIABLE BEAT FREQUENCY OSCILLATOR UNIT A8
RF TUNER ASSEMBLY
LOCAL OSCILLATOR UNIT A4
PANEL AND CHASSIS ASSEMBLY
IF AMPLIFIER UNIT A5
IF OUTPUT UNIT A6
AF AMPLIFIER UNIT A9
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Figure 1-2. Radio Receiver R-901/GR, Top View, RF Tuner Assembly Shield Removed.

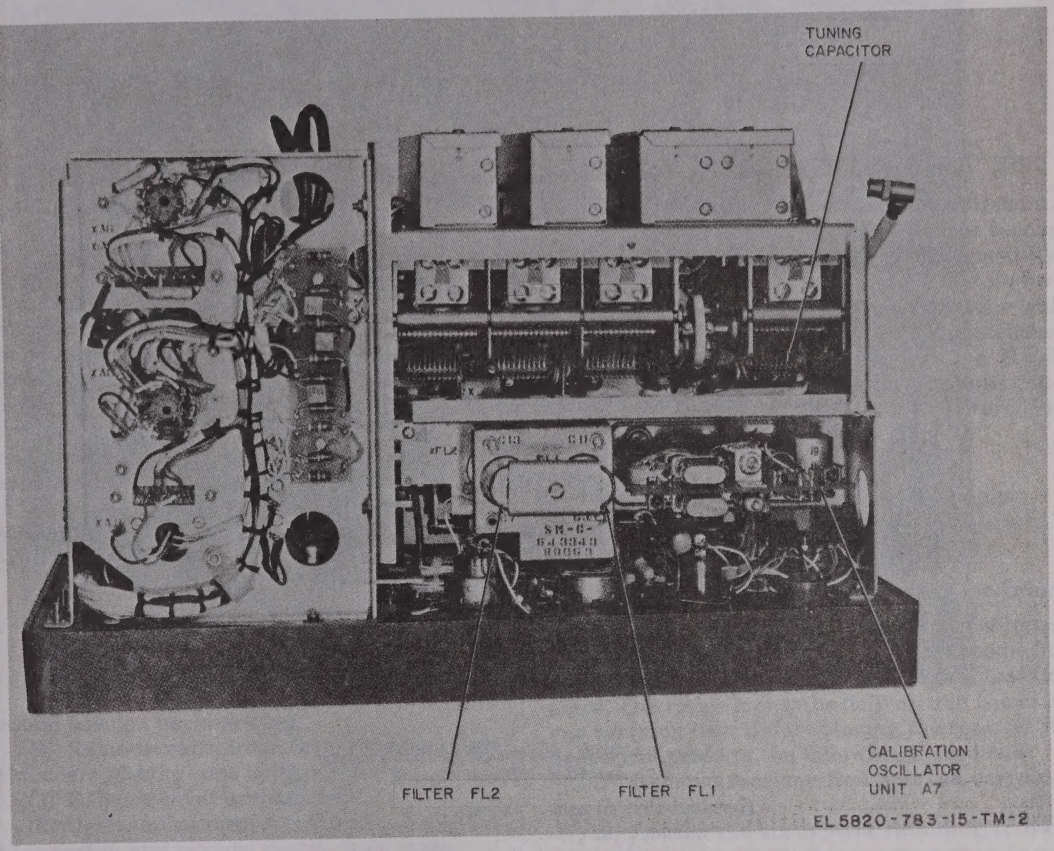


Figure 1–3. Radio Receiver R–901/GR, Bottom View.

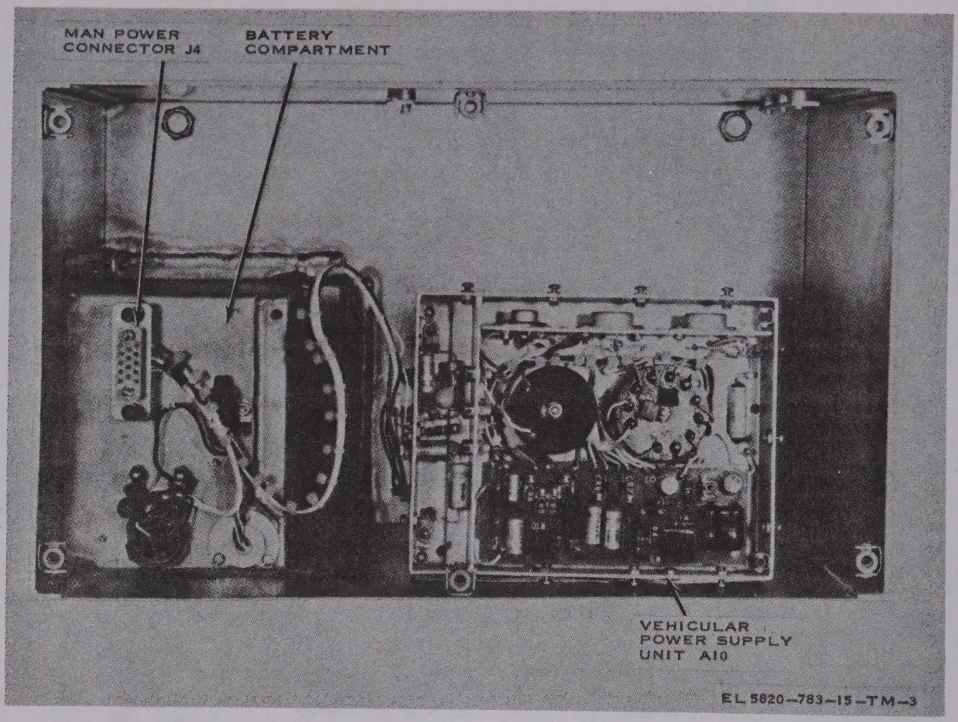


Figure 1-4. Radio Receiver R-901/GR Housing Assembly, Interior View.

CHAPTER 2

INSTALLATION

-1. Unpacking

a. Packaging Data. When packed for shipent, the components of Radio Receiver -901/GR are in an overseas pack container. nat is, the components listed in paragraph 1–6 re placed in a corrugated carton. This inner ntainer is placed in an outer carton which is acked in a wooden packing case. Each of the rrugated cartons is enclosed in a moisturoof barrier. Figure 2–1 illustrates a typical acking case and its contents.

b. Removing Contents. Perform the steps sted below to unpack equipment from case (fig -1).

CAUTION

Do not pry open case with prybar or crowbar. Equipment within case may be damaged.

(1) Cut and fold back any metal straps round wooden packing case.

(2) Remove nails from cover and one side f wooden packing case using nailpuller.

(3) Remove cover and one side.

(4) Open moistureproof barrier cover in uter carton and remove carton from case.

(5) Open carton and moistureproof barrier overing inner carton.

(6) Remove inner carton and open.

(7) Remove contents from inner carton. ave cartons, inner blocking, fillers, etc, for uture limited storage of receiver and running pares.

-2. Checking Unpacked Equipment

a. Inspect the equipment for damage incured during shipment. If any damage is found, eport on DD Form 6 (para 1–3*b*).

b. See that the equipment supplied is comlete as listed on the packing slip. If a packing lip is not available, check the equipment gainst the components of Radio Receiver R–901/GR listed in paragraph 1–6. Report all iscrepancies in accordance with TM 38–750. Shortage of a minor assembly or running spares hat does not effect functioning of the equipment should not prevent use of the equipment.

c. If the equipment has been used or reconditioned, see whether it has been changed by modification work order (MWO). If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see whether the MWO number (if any) and appropriate notations concerning the modification have been entered in the equipment manual.

NOTE

Current MWO's applicable to the equipment are listed in DA Pam 310–7 (*see* paragraph 1–2).

2–3. Installation for Man-Portable Operation

a. Receiver Check. The receiver is shipped completely assembled with all internal connecting cables, plug-in modules and the fuse in place. The receiver may be delivered in the canvas carrying bag. Before placing the receiver in operation, perform the following procedures:

(1) Remove receiver from canvas carrying bag (if so received).

(2) Loosen the six captive retaining screws on the front panel and slide receiver chassis out from case.

(3) Check that all plug-in units are properly seated and that retaining screws are tight or locked.

(4) Check that all internal cables are properly and firmly positioned.

(5) Check the fuse mounted on the front panel and replace if found to be defective.

CAUTION

Use a ½ ampere, FO2A–250V1/2A fuse only.

(6) Replace receiver chassis in case, checking that chassis is properly seated in case.

(7) Tighten the six retaining screws on the front panel.

b. Battery Installation. The "A" battery, BA–403/U, and "B" battery BA–418/U are both housed in a compartment located at the rear of the housing assembly (figure 1–4). This compart-

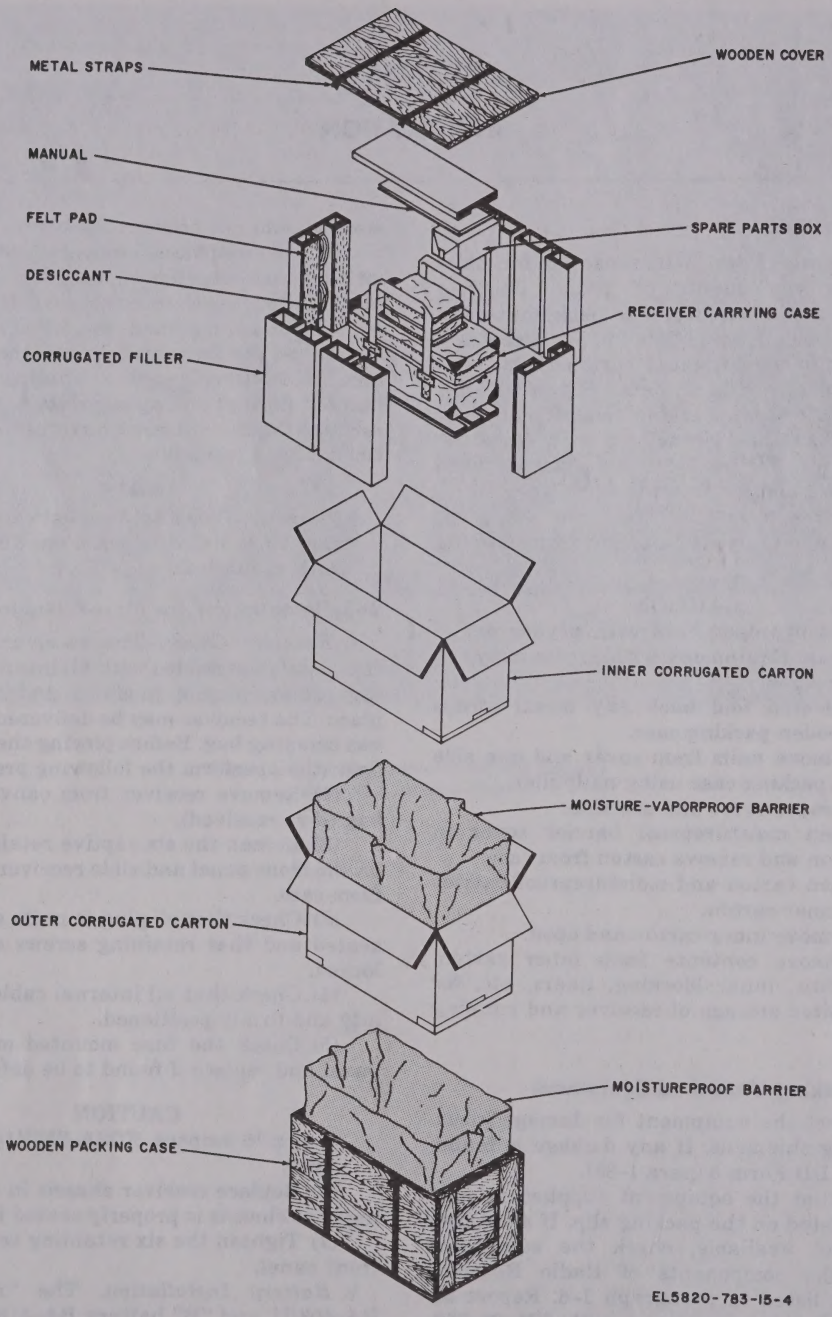


Figure 2-1. Typical Packaging, Radio Receiver R-901/GR.

ment is closed by a watertight panel, retained by four turnlock fasteners. To install batteries, proceed as follows:

(1) Loosen the four (4) turnlock fasteners securing the battery compartment door and remove door.

(2) Disconnect battery plugs from receptacles on compartment wall and remove battery plugs from inside of the compartment.

(3) Place one each BA–403/U and BA–418/U battery adjacent to the battery compartment. Batteries must be placed with receptacles up.

(4) Insert battery plugs into the receptacles. Battery plugs are polarized to prevent insertion into the wrong battery terminals.

(5) Insert BA–418/U battery into the compartment against the side wall. Insert BA–403/U battery into the compartment. Both batteries should have the receptacles facing outward (towards the compartment opening).

(6) Replace compartment door and secure by turning turnlock fasteners.

c. DF Antenna Connections. To connect df antenna to receiver, remove the protective cap from the 50 ohm antenna receptacle on the front panel of the receiver and connect the coaxial cable from the antenna to receptacle. The cable and antenna are not supplied with the receiver. The receptacle is a type UG–912/U coaxial receptacle with an input impedance of 50 ohms, unbalanced. For installation details concerning the preparation, erection, and orientation of the direction finding antenna, consult the applicable direction-finder system manual.

d. Whip Antenna. The whip antenna is a communication antenna equipped with a coaxial lead-in cable that is required for intercept (monitoring and recording) operations. To connect the whip-type antenna to the receiver, remove the protective cap from the WHIP ANT receptacle on the receiver front panel and connect the antenna lead-in cable.

e. Headset. Connect any suitable headset, 600 ohm, to the AUDIO jack on the receiver front panel. The headset is not supplied with the receiver.

2–4. Vehicular Installation

a. Receiver Check. After the receiver has been unpacked, perform the check described in paragraph 2–3*a*.

b. Mounting Base. Install the mounting base in the vehicle or shelter in accordance with the appropriate installation instructions for the vehicle into which the receiver is being installed.

c. Receiver Installation. Place the receiver on the mounting base and check that the receiver is seated against guide pins on rear of the base. Then tighten wing bolts on front of base to secure receiver in place.

d. Power Connection. The VEH POWER connector on the front panel of the receiver should not be used for normal vehicular operation. To make up the power connection for vehicular use of the receiver, remove the battery compartment cover per paragraph 2–3*b*(1) and connect 24-volt dc power cable to receptacle J4 in battery compartment at rear of receiver. The power cable is part of the vehicular power system. Use applicable instructions supplied with vehicular system for routing and installation of cable. Check that POWER switch on the receiver front panel is in the OFF position before completing cable connections to vehicular battery or power supply.

NOTE

To avoid possible damage caused by deterioration of batteries, internal batteries shall not be installed during vehicular operation.

e. DF Antenna Connections. For information concerning location, erection, and orientation of direction-finding antenna, consult the applicable technical manual for the antenna or direction-finding system. Connect the coaxial antenna lead-in to the 50 OHM antenna receptacle on the front panel of the receiver.

f. Whip Antenna. The intercept antenna (not supplied with the receiver) should be a whip-type of suitable design. Consult the instructions provided with the antenna or vehicular system to position and mount antenna and to route antenna lead-in to the receiver. Remove the protective cap from the WHIP ANT receptacle and connect the antenna lead-in to the receptacle.

g. Headset. Connect suitable 600-ohm headset (not supplied) to the AUDIO jack on the receiver front panel.

h. DF System Connections. If receiver is being used as part of a direction-finding system, connect input to direction-finding indicator unit from DIODE OUTPUT connector on front panel of receiver. Follow applicable instructions supplied with vehicle or direction-finding system for routing of interconnection cable and installation.

2–5. Initial Adjustments

a. No initial adjustments of the receiver itself are required prior to operation.

b. The meter zero potentiometer is located behind the front panel of the receiver. The setting of this potentiometer is part of the alignment procedure and should not be adjusted prior to operation.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. OPERATOR'S CONTROLS AND INDICATORS

3-1. Controls and Indicators

a. Locations. All controls and indicators for normal operation of the receiver are located on the front panel (fig 3-1). The meter zero set control is located behind the meter. This control is set as part of the receiver alignment and does not require further adjustment for normal operation.

b. Functions. Operating controls and indicators of Radio Receiver R-901/GR and their respective functions.

Control or Indicator		*Function*
CAL ADJ knob		Adjusts tuning hairline so that dial indicates correct frequency at calibration check point
BAND SWITCH		Selects one of five frequency bands
BFO PITCH control		Varies beat frequency oscillator±3 kHz
POWER switch		
	BATT	Connects receiver to internal batteries
	OFF	Disconnects power sources
	VEH	Connects vehicular storage battery to internal power supply; applies output voltages of power supply to remainder of receiver
FUNCTION switch		
	AM	Provides AM reception
	CW	Provides CW reception
	CAL	Allows checking frequency setting of tuning dial
DIAL LIGHT switch		
	ON	Turns dial light on
	OFF	Turns dial light off
BANDWIDTH switch		
	1.5 KC	Selects bandwidth of 1.5 kHz
	4 KC	Selects bandwidth of 4 kHz
ANT TRIM control		Tunes antenna circuit to proper resonant frequency
DIAL LOCK		Locks tuning dial
METER switch		Connects meter to read A+ voltage, B+ voltage, vehicle battery voltage, or signal level
AF GAIN control		Adjusts receiver audio output level
RF GAIN control/AGC switch		Adjusts gain of or applies AGC voltage to RF and IF amplifiers
ANT switch		Selects 50 ohm (DF) or whip antenna input to receiver
Tuning dial		Drum-type dial displaying selected frequency in one of five bands (MHz): Band 1 0.536 to 1.15 Band 2 1.10 to 2.36 Band 3 2.26 to 4.84 Band 4 4.65 to 9.9 Band 5 9.5 to 20.5
FUSE ½ AMP		Provides overload protection for receiver

Section II. OPERATION

3-2. Types of Operation

Radio Receiver R-901/GR, when connected to a suitable antenna, may be operated as either part of a direction-finder set to determine the directional location (bearing) of an unknown transmitter in the high frequency range or as a communication receiver to analyze and/or monitor transmissions. The receiver can receive am, cw or mcw signals.

a. For cw reception, the FUNCTION switch must be in the CW position. The BFO PITCH control may be adjusted in either direction to produce an audio note that can be heard once the unknown transmitter's frequency has been found.

b. For recording or monitoring through the headset particularly am transmissions, the RF GAIN control should be set to the AGC position to minimize signal strength variations. For recording or monitoring cw or modulated cw transmissions, the RF GAIN control should be set to a position providing best audio level signal.

3–6. Use of Dial Light

To illuminate dial light in any mode of operation, set DIAL LIGHT switch to ON position. To cut off dial light, set DIAL LIGHT switch to OFF position.

3–7. Stopping Procedure

To shut down receiver, set POWER switch to OFF position.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

3–8. General

The operation of Radio Receiver R–901/GR may be difficult or pose unusual problems in regions where extreme heat or cold, humidity and moisture, sand conditions, etc., prevail. The recommended procedures to minimize the effect of unusual environmental conditions are given in the paragraphs that follow.

3–9. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather can affect operation of the receiver. Instructions and precautions for operation under such adverse conditions include:

a. Keep the equipment warm and dry as much as possible. Stow the receiver in a heated enclosure until it is to be used in man-portable operation.

b. Batteries should be protected from freezing as much as possible using any improvised means. Batteries should not be installed in the receiver until just before use. Keep heat loss to a minimum when carrying the receiver with batteries installed outside of a heated enclosure by carrying the receiver in a bag lined with kapok, spun glass, fiber materials, animal skins, or woolen cloth.

c. When the receiver has been brought into a heated enclosure after having been exposed to the cold, it will sweat until it reaches room temperature. After the receiver has reached the warmer temperature, dry it thoroughly using soft dry cloths.

d. A receiver that has been exposed during a cold night will sweat when the equipment warms up during the day, particularly when placed in direct sunlight. Dry the receiver thoroughly using soft dry cloths when such sweating conditions are observed.

3–10. Operation in Tropical Climates

High temperature and humidity conditions of tropical climates can affect the receiver and the batteries. To minimize these effects, follow the precautions given below:

a. Remove batteries from receiver whenever the receiver is not used in the man-portable operation to minimize corrosion of battery case and battery connectors.

b. High relative humidity can cause condensation of moisture within the receiver case whenever the receiver's internal temperature becomes lower than that of the surrounding atmosphere. This condition could occur, for example, when the sun rises and the receiver has been stored in a protected location during the night. To minimize internal moisture condensation, keep receiver warm using a lighted electric bulb or equivalent under or next to receiver, and keep receiver in location where forced air ventilation exists.

3–11. Operation in Desert Climates

Conditions similar to those of tropical climates often exist in desert areas. Use the precautions of paragraph 3–10 where applicable, and, in addition, note the following precautions:

a. Sand and dust may work into moving parts such as the tuning components, dial, etc. Keep the receiver in as dustproof an area as possible, using available materials to seal off the storage or using location.

b. Keep battery compartment closed as much as possible to keep sand and dust from working into it. Keep receiver panel covered as much as possible when not in use by enclosing it in the carrying bag, covered with canvas, or similar measures.

c. Check to see that adequate flex exists in cables connected to front panel when in man-portable mode of operation to minimize pull on panel connectors in the event of sudden wind squalls, common in desert areas.

CHAPTER 4

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE

Section I. OPERATOR'S MAINTENANCE INSTRUCTIONS

4-1. Scope of Operator's Maintenance

The maintenance duties assigned to the operator are listed below. These duties apply to Radio Receiver R-901/GR. Corresponding operator's maintenance duties for other equipment with which the receiver may be operated will be found in the applicable technical manuals and bulletins. No tools or test equipment are required for performance of operator's maintenance duties for the receiver.

a. Preventive maintenance (para 4-2 through 4-4).

b. Visual inspection (para 4-6).

c. Cleaning (para 4-5).

d. Operational checklist (para 4-7).

4-2. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce time in which equipment is unserviceable (downtime), and to keep equipment as fully serviceable as possible under actual use conditions. Preventive maintenance practices should be followed daily in accordance with paragraph 4-3 and weekly in accordance with paragraph 4-4. In addition, full daily and weekly maintenance functions should be performed any time that the receiver is to be used on a mission, when the mission is completed, when the receiver has been reinstalled in a vehicle after being removed for any reason, or when the receiver is removed from a standby condition.

4-3. Operator's Daily Preventive Maintenance Checks and Services Chart

Item	*Maintenance Procedure*
1	Check for completeness and general condition of receiver and spares per paragraph 1-6.
2	Check that fuse is good and firmly in place on front panel.
3	Check to see that all controls operate smoothly, that knobs are tight on shafts, and that no binding occurs in operation of controls.
4	Check for normal operation in accordance with operational check-list of paragraph 4-7.
5	In vehicular installation, check that receiver is firmly in place on mounting base and that securing clamps are tight.
6	Inspect case for signs of rust or corrosion.
7	Inspect all external cables and cords for cuts, broken insulation or loose connectors.
8	Inspect canvas carrying case (if provided) for tears, fraying, mildew or rot.

4-4. Operator's Weekly Preventive Maintenance Checks and Services

All daily preventive maintenance functions of paragraph 4-3 should be performed weekly with the addition of cleaning per paragraph 4-5 of the following items:

a. Exterior of receiver.

b. Headset.

c. Mounting base (if in use).

d. Cover glasses of dial and meter on front panel.

4-5. Cleaning

a. Remove all loose dirt from case with a clean soft cloth.

WARNING

Prolonged breathing of cleaning compound is dangerous; make sure that adequate ventilation is provided. Cleaning compound is flammable; do not use near fire or open flame. Avoid contact with skin or eyes; wash off any spillage on hands, face or other parts of body immediately. Flush eyes with water immediately in cases of splashing of compound.

b. Remove grease, fungus, and ground-in-dirt from receiver case using a cloth dampened (not wet) with cleaning compound (FSN 7930-395-9542).

c. Clean dirt, grease, or fungus from canvas carrying case using brush or cloth moistened with cleaning compound.

d. Remove dirt from plugs and receptacles using a stiff-bristled brush.

CAUTION

Do not press on cover glasses of meter or dial when cleaning to avoid breaking glass or damaging meter movement.

e. Clean front panel, meters, dials and control knobs with soft clean cloth. If dirt is difficult to remove, dampen cloth with water. If dirt still can not be removed, use mild soap on cloth and wipe dry thoroughly with a soft dry cloth.

4–6. Visual Inspection

a. When the receiver does not perform properly, turn off power and check the items listed below. Do not check any item with POWER switch in either BATT or VEH position.

(1) Wrong settings of switches and controls (para 3–1).

(2) Improper connection of power cable (in vehicular installation), headset cord, or antenna lead-in cables (para 2–3 and 2–4).

(3) Disconnect cables, plugs or headset cord.

(4) Bad ground connections.

(5) Low battery voltage (in man-portable operation).

b. If the above checks do not locate the cause of the trouble, proceed to operational check list of paragraph 4–7.

4–7. Operational Check List

a. General. The operational check list will assist the operator to locate the trouble quickly. The corrective measures are used to repair the trouble. If the measures suggested do not restore normal receiver performance, troubleshooting and/or repair is required by organizational repairman or to a higher category of maintenance.

b. Procedure. To check the operation of the receiver, perform the steps shown in the operational check list that follows, in the order given. Do not proceed with any following step until an abnormal condition has been corrected. Steps 1 through 3 are used only when batteries have been installed in the battery compartment. Steps 4 through 6 are used only when the receiver is installed in a vehicle or shelter with 24-volt dc power available to the connector in the battery compartment.

Action	*Normal Indication*	*Corrective Measures*
1. Set POWER switch to BATT		
2. Set METER switch to A+	Meter pointer deflects to "GOOD" (green portion of scale	"A" battery requires replacement by organizational repairman
3. Set METER switch to B+	Meter pointer deflects to "GOOD" (green) portion of scale	"B" battery requires replacement by organizational repairman
4. Set POWER switch to VEH and set METER switch to VEH	Meter pointer indicates between 20 and 32 volts	Check cable and connector to battery compartment from vehicular supply. Higher category repair required
5. Set METER switch to A+	Meter pointer deflects to "GOOD" (green) portion of scale	Higher category repair required
6. Set METER switch to B+	Meter pointer deflects to "GOOD" (green) portion of scale	
7. Set DIAL LIGHT switch to ON	Dial light is illuminated	Dial lamp requires replacement by organizational repairman
8. Set BAND SWITCH to 1, set FUNCTION switch to CAL, release DIAL LOCK and rotate TUNING control to nearest dial calibration red check point	Audio tone is heard in headset	Check FUNCTION switch setting, check dial for setting, check RF GAIN control setting. Higher category repair required
9. Check for other dial calibration checkpoints with FUNCTION switch in CAL position by rotating TUNING control and changing BAND SWITCH setting	Audio tone is heard in headset at or near each red checkpoint on dial	Check FUNCTION switch setting. Check RF GAIN and AF GAIN control settings. Higher category repair required

Section II. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

4–8. Scope of Organizational Maintenance

Organizational maintenance of the radio receiver includes procedures that the operator is authorized to perform. In addition, the following procedures shall be performed by the organizational personnel.

a. Monthly preventive maintenance checks and services chart (para 4–9).

b. Replacement of fuses, indicator lamps, and batteries (para 4–10 through 4–12).

4-9. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	Reference
1	Pluck-Out Items	Check seating of indicator lamps, connectors and plug:in modules	para 2-3*a*
2	Battery compartment	Open the battery compartment door and check the interior for evidence of water leakage, condensation and corrosion	para 2-3b
3	Batteries	Test the batteries under load: BA-403/U is between 1.30 and 1.50 volts BA-418/U is between 38 and 45 volts	

4-10. Replacement of Fuse

The fuse is installed in a fuse holder in the front panel. To replace fuse, remove the fuse holder from the front panel; replace fuse and reinsert fuse holder into the front panel.

4-11. Replacement of Dial Lamp

To replace the dial lamp of the radio receiver, proceed as follows:

a. Unscrew the six, captive panel screws and remove the receiver from its case.

b. The lamp socket is located above the dial scale. Turn the knurled knob on the socket assembly counterclockwise until the base connection is disconnected. Loosen the hexagonal nut and slip the lamp holder out of the mounting bracket.

c. Replace the lamp and reassemble.

4-12. Replacement of Batteries

The batteries are installed in a compartment at the rear of the receiver. When no batteries are installed, the battery plugs are fastened to a storage receptacle on the right wall of the compartment.

a. Loosen the turnlock fasteners securing the battery compartment door and remove the door.

b. Disconnect the two plugs from the receptacle on the compartment wall and pull them out of the compartment.

c. Place the batteries, with the receptacles up, adjacent to the open compartment and insert the plugs into the battery receptacles. The plugs are polarized to prevent incorrect installation.

d. Insert BA-418/U into the compartment against the side wall. Insert BA-403/U into the compartment. The battery receptacles should face the compartment opening. Replace the door and secure the turnlock fasteners.

CHAPTER 5

CIRCUIT FUNCTIONING

Section I. BLOCK DIAGRAM DISCUSSION

5-1. General

Radio Receiver R-901/GR is a mobile and portable superheterodyne receiver, continuously tunable over the frequency range of 0.536 to 20.5 mHz. The frequency range is covered in five overlapping bands. The receiver is capable of receiving continuous wave (cw), modulated continuous wave (mcw) and amplitude modulated (am) signals throughout its range. Tuning dial accuracy is checked by using an internal crystal-controlled calibration oscillator with dial calibration check points available every 200 kHz between 600 and 4800 kHz and every 1 mHz between 5 mHz and 20 mHz. The receiver has an audio output receptacle and a separate diode output receptacle. The latter provides signals for certain types of bearing indicators in direction-finding systems. Figure 5-1 is a block diagram of the receiver signal paths. The block diagram is discussed in paragraphs 5-2 through 5-7. Figure 5-2 is a complete schematic diagram of the receiver. The complete circuit is discussed in section II of this chapter.

5-2. RF Stages

The rf signal is taken from the receptacles, 50 OHM J2 or WHIP J1 to which the different antennas are connected, as selected by ANT selector switch S1. The selected antenna input is routed to the first rf amplifier unit A1 through the antenna circuit. The first rf amplifier plug-in unit feeds into the second rf amplifier plug-in unit A2. The output of the second rf amplifier feeds into the mixer unit A3. The mixer also receives an rf signal from the local oscillator unit A4. The output circuit of the mixer is tuned to the difference frequency, 455 kHz, of the two rf signals into the mixer. This 455 kHz signal is the intermediate frequency (if) of the receiver. Tuning of the rf amplifiers and local oscillator is performed by the receiver tuning control and the frequency band setting of BAND SWITCH A11S1 in the rf tuner A11. Gain settings of the two rf amplifier stages are made by the front panel RF GAIN control and can be either manual or automatic from the automatic voltage control (AVC) circuit through switch S7 on the RF GAIN control.

5-3. IF Amplifier and Detector Stages

The if output of the mixer is coupled to the if amplifier unit A5 through one of two mechanical filters. The selection of the filter inserted into the signal path is made by BANDWIDTH switch S5. Filter FL1 provides a 1.5 kHz amplitude modulation bandwidth; filter FL2 provides a 4 kHz bandwidth. IF amplifier unit A5 is a two-stage amplifier. The if signal through the selected filter is coupled into the first stage and the output of the first stage is coupled into the second stage. The output of the second stage is applied to if output unit A6. This is a multi-stage unit, the first of which is another stage of if amplification. The amplified if signal is rectified by the diode output circuit and fed to DIODE OUTPUT receptacle J9 on the front panel. This diode output is for use with a bearing indicator when the receiver is part of a direction-finding set. The output of the if amplifier stage of unit A6 is also rectified in a circuit built around diode A6CR1. This circuit provides the detected output for the audio stages. It also provides the AVC voltage for the receiver.

5-4. Audio Stages

The demodulated output of the diode detector CR1 is applied to audio frequency amplifier A9. This is a two-stage vacuum tube type amplifier. The output of the amplifier is applied to a solid-state stage of amplification in the receiver. The output of the audio output stage, Q1, is applied to the AUDIO OUTPUT receptacle J3 on the front panel.

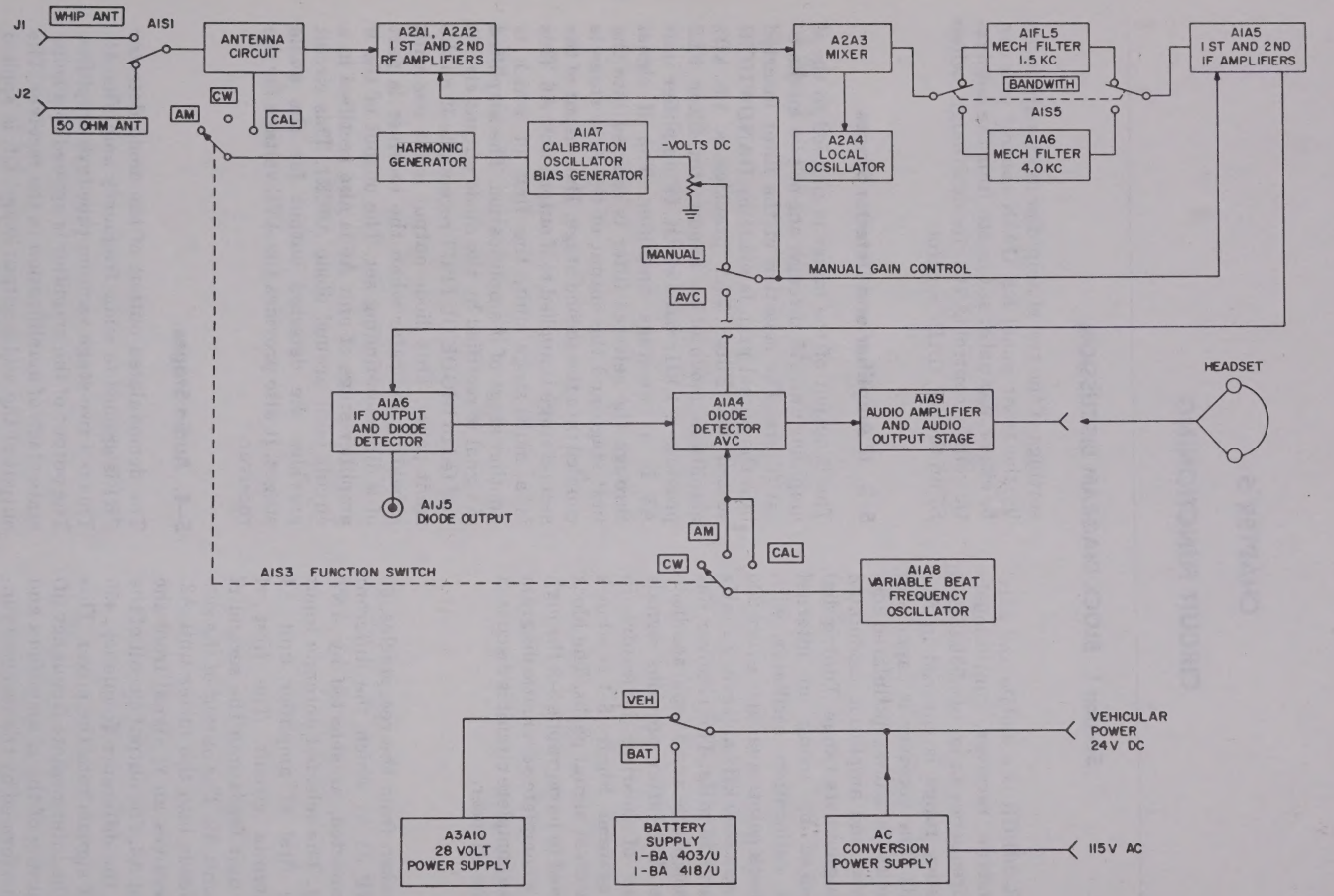
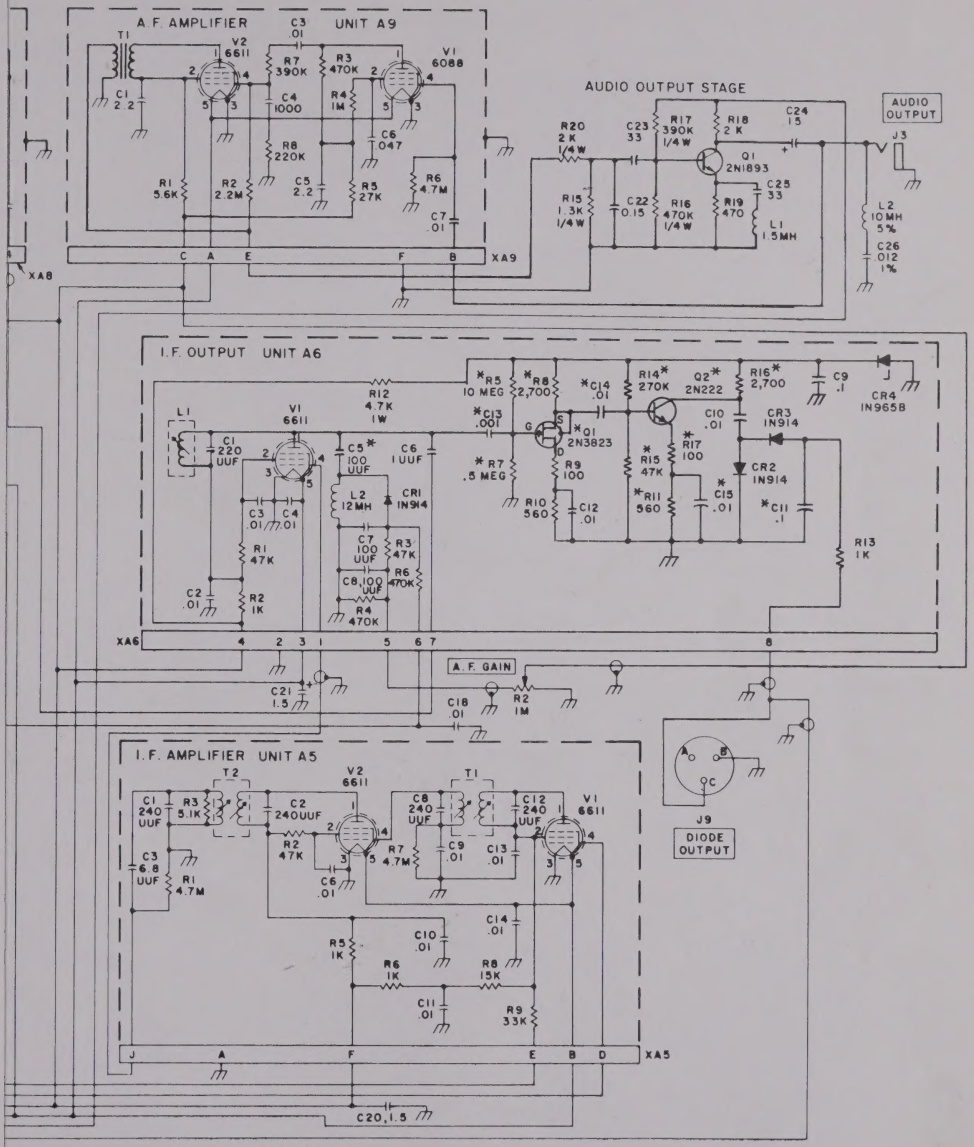


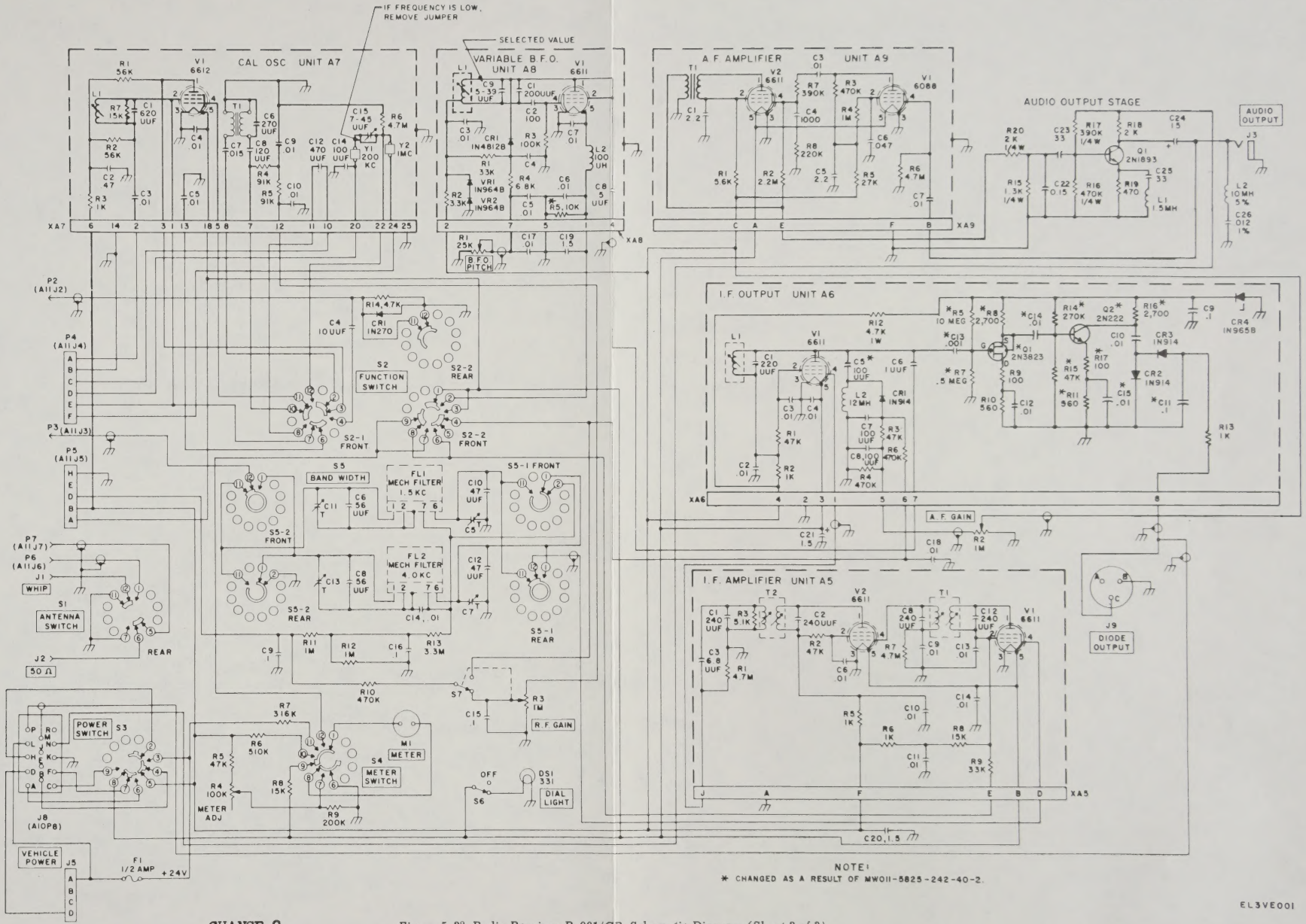
Figure 5-1. Block Diagram, Radio Receiver R-901/GR.



NOTE:
* CHANGED AS A RESULT OF MWO11-5825-242-40-2.

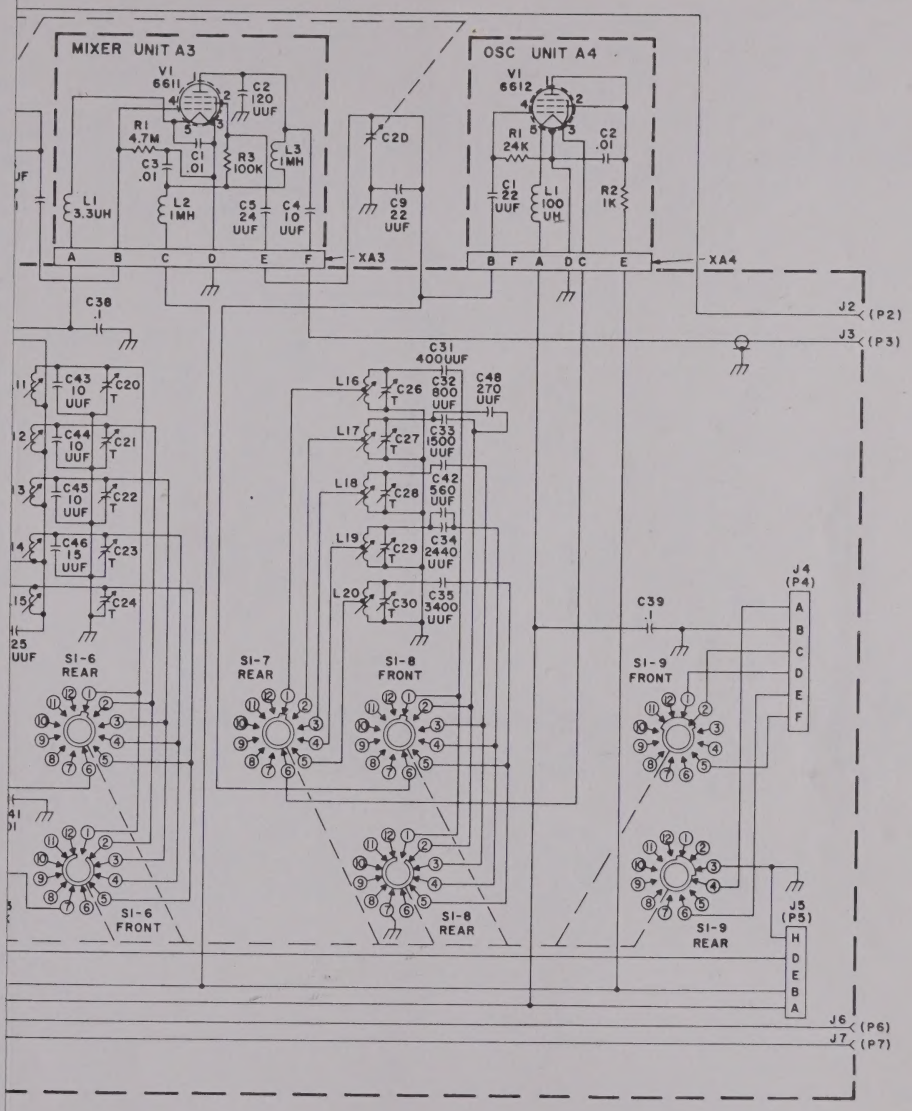
EL3VE001

R, Schematic Diagram (Sheet 2 of 3).



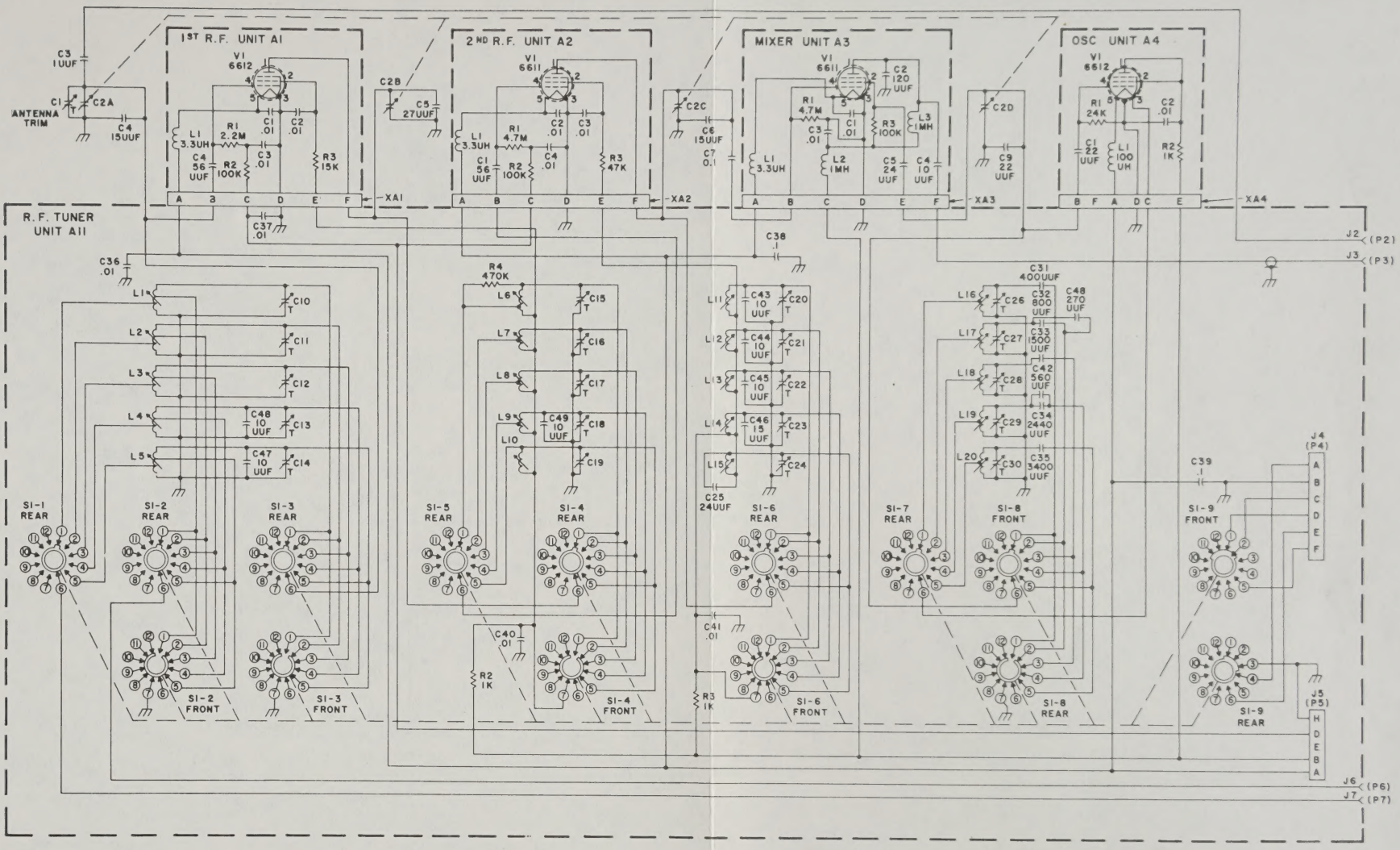
CHANGE 2

Figure 5-2². Radio Receiver R-901/GR, Schematic Diagram (Sheet 2 of 3).



EL5820-783-15-6 (PART 1 OF 3)

Figure 5-2①. Schematic Diagram, Radio Receiver R-901/GR (sheet 1 of 3).

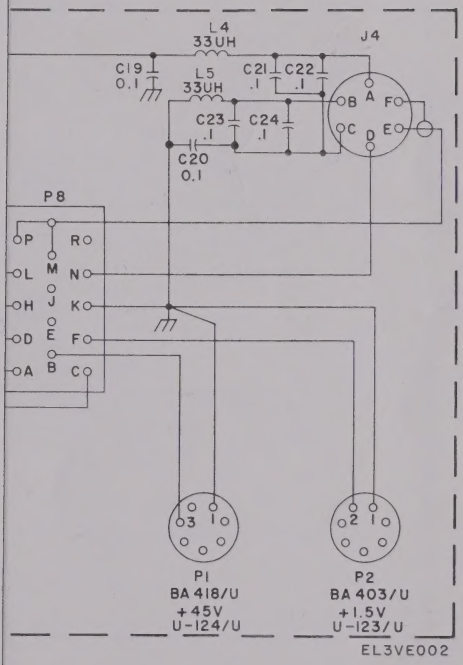


NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTORS ARE IN OHMS. CAPACITORS ARE IN UF.
2. [ ] INDICATES EQUIPMENT MARKINGS.
3. ROTARY SWITCHES ARE SHOWN IN EXTREME COUNTER CLOCKWISE POSITION. SECTIONS DESIGNATED "FRONT" ARE NEAREST THE CONTROL KNOB. FRONT OF SECTION IS SIDE TOWARD CONTROL KNOB.
4. REF DESIG PREFIX UNIT 1 AND 2
5. FOR ASSEMBLY SEE DWG SM-D-643371

EL5820-783-15-6 (PART 1 OF 3)

Figure 5-2①. Schematic Diagram, Radio Receiver R-901/GR (sheet 1 of 3).


L4
33UH
J4
C19
0.1
L5
33UH
C21
.1
C22
.1
C23
.1
C24
.1
C20
0.1
A
B
C
D
E
F
P8
P
R
M
L
N
J
H
K
E
D
F
B
A
C
3
1
2
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P1
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+45V
U-124/U
P2
BA 403/U
+1.5V
U-123/U
EL3VE002

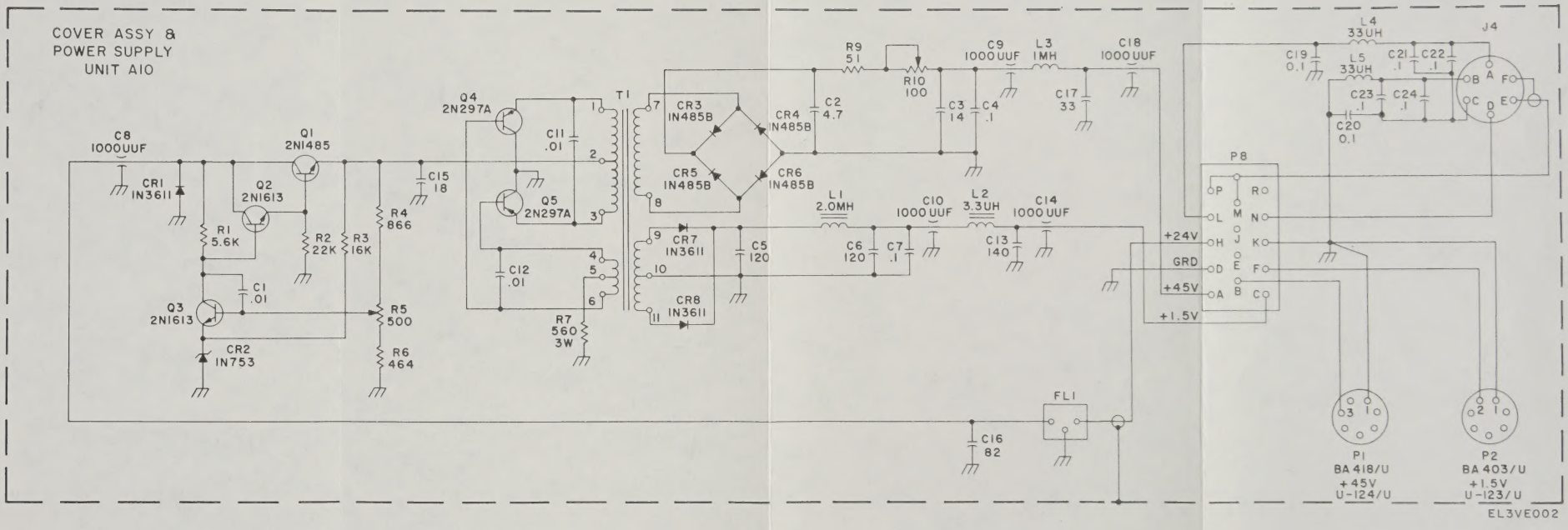

Figure 5-2[3]. Radio Receiver R-901/GR, Schematic Diagram Power Supply Unit A 10 (Sheet 3 of 3).

5-5. Beat Frequency Oscillator

The beat frequency oscillator (bfo) unit A8 functions when power is applied to the filament of the bfo tube A8V1. This is a variable frequency oscillator whose output frequency can be varied ±3 kHz with respect to the 455 kHz intermediate frequency. The bfo output is applied to the diode detector circuit in unit A6 when FUNCTION switch S2 is set to either the CW or CAL position. The beating of the bfo input against the if signal provides an audio note for obtaining an audible cw signal or for dial calibration purposes.

5-6. Calibration Oscillator and Harmonic Generator

When FUNCTION switch S2 is set to the CAL position, the output of the calibration oscillator A7 is applied to the antenna input circuit. The calibration oscillator is crystal-controlled oscillator with two crystals. One crystal provides a 200 kHz fundamental frequency of the oscillator with BAND SWITCH A11S1 set for band 1, 2 and 3. The other crystal provides a 1 mHz fundamental frequency with A11S1 set for band 4 or 5. The fundamental frequency of the oscillator is applied to a harmonic generator circuit, CR1, to produce a full spectrum of harmonic frequencies for dial calibration throughout the entire receiver range. The harmonic generator output is coupled into the antenna input circuit just before the first rf amplifier. The calibration oscillator is also the source of the negative dc voltage for manual gain control.

5-7. Power Supply

The receiver can be operated from either internal batteries or from an external vehicular power supply of 24-volts dc. The selection of power source is made from the front panel POWER switch S3. In the BATT ON position, the 45-volt B+ and transistor voltage are taken from a BA-418/U battery and the +1.5-volt filament supply is taken from a BA-403/U battery. In the VEH ON position of S3, the two voltages are taken from the internal power supply unit A10 and the power supply is connected to the +24-volt vehicular battery. The power supply is a dc-to-dc converter, all solid state.

Section II. CIRCUIT DESCRIPTIONS

5-8. General

The circuits of the receiver are described individually in this section. These circuits are shown in the receiver schematic diagram, figure 5-2. Where applicable, individual partial schematic diagrams and switching diagrams are included with the detailed circuit descriptions.

5-9. Antenna Circuit

a. The rf signal enters the receiver through either WHIP antenna receptacle J1 or 50 OHM receptacle J2. The selection of the input source is made by ANT. selector switch S1. With S1 in the 50 OHM position, the whip antenna input to terminal 12 of the rear deck of S1 is grounded through terminal 11 of the switch and the 50 ohm input to terminal 6 of S1 is patched through terminal 5 of S1 to connector A11J7 on the rf tuner. With S1 in the WHIP position, the whip antenna is patched through terminals 12 and 1 of S1 to connector A11J6 on the rf tuner and the 50 ohm input is grounded through terminals 6 and 7 of S1.

b. The whip antenna input through A11J6 is connected to the rear section of deck 1 of BAND selector switch A11S1 and the 50 ohm antenna input through A11J7 is connected to the rear section of A11S1-2. These switch sections connect one of five adjustable coils (A11L1 through A11L5) into the antenna tuning tank circuit. The front sections of decks 2 and 3 of A11S1 ground the unused coil. Each adjustable coil has an adjustable trimmer A11C10 through A11C14 for optimum rf tracking on the corresponding band. The selected coil is connected into the remainder of the tank circuit through the rear section of deck 3 of A11S1. The remainder of the tank circuit, used to tune the antenna circuit to resonance, is made up of section A of variable tuning capacitor C2, antenna trim capacitor C1 and capacitor C4. The input signal developed across the resonant circuit is applied to pin B of the first rf amplifier, unit A1.

5-10. First RF Amplifier

a. The first rf amplifier, unit A1, is a plug-in module that is mounted on the rf tuner. The amplifier provides one stage of rf amplification using a subminiature-type vacuum tube A1V1. This tube is a type 6612 pentode.

b. The rf signal into the amplifier from the antenna circuit is through pin B of the module and is applied to the grid (pin 4) of A1V1. There

is decoupling network on the grid which also has the negative gain control (manual or AVC) voltage applied to it through pin C of the module. The filament supply is through pin A of the module to the indirect heater (pin 5) of A1V1.

c. The plate circuit of A1V1 is tuned by section B of variable tuning capacitor C2 (and capacitor C5) along with the selected coil from the group A11L6 through A11L10. The coil selection is made by the rear sections of decks 4 and 5 of A11S1 with the unused rf coils short-circuited by A11S1. The screen (pin 2) of A1V1 has a decoupling network connected to it.

5–11. Second RF Amplifier

a. The second rf amplifier, unit A2, is a plug-in module that is mounted on the rf tuner. This amplifier provides an additional stage of rf amplification using a subminiature-type vacuum tube A2V1. This tube is a type 6611 pentode.

b. The second rf amplifier is substantially the same as the first rf amplifier and the description given in paragraph 5–10 applies to unit A2. The differences lie in the plate circuit components of the amplifier. In the case of the second rf amplifier, the plate circuit is tuned by section C of variable tuning capacitor C2 along with the selected coil from the group A11L11 through A11L15. The coil selection corresponds to the selected band and is made by deck 6 of A11S1 with the unused coils being short-circuited by the switch.

5–12. Local Oscillator

a. The local oscillator, unit A4, provides the rf frequency into the mixer to develop the intermediate frequency. The oscillator is a plug-in module mounted on the rf tuner.

b. The local oscillator uses a type 6612 subminiature-type vacuum tube, A4V1, in a modified Hartley oscillator circuit. The +1.5-volt filament input is to the filament-cathode pin 5 through pin A of the module. The choke A4L1 in the filament circuit presents a high rf impedance between filament and ground in order to have the filament perform the same function as an indirectly heated cathode in the same type of circuit. Feedback to maintain oscillation is accomplished by connecting filament pin 3 of A4V1 to the tap on the oscillator tank circuit through pin C of the module and the rear section of deck 7 of BAND selector switch A11S1. The plate (1) and screen (2) are connected and both are decoupled from the plate supply through a network made up of resistor A4R2 and capacitor A4C2.

c. Frequency of oscillation is set by a tank circuit made up of section D of the variable tuning capacitor C2 and the sellected coil. The coil is selected by A11S1 from the group of coils A11L16 through A11L20. Grid leak bias is maintained by capacitor A4C1 and resistor A4R1. The signal developed across the tuned circuit of the oscillator is fed to the mixer, unit A3, from the tap between the tuning capacitor and the wafer of A11S1 connecting the selected coil.

5–13. Mixer Stage

a. The mixer stage beats the incoming rf signal from the second rf amplifier and the signal from the local oscillator to obtain the if signal. The mixer, unit A3, is a plug-in module on the rf tuner. The mixer uses a type 6611 subminiature pentode, A3V1.

b. The incoming rf signal from the second rf amplifier is applied to the grid, pin 4, through pin B of the module. The +1.5-volt filament voltage is applied to pin 5 of A3V1 through pin A of the module and is rf decoupled by choke coil A3L. The local oscillator signal is applied to the screen, pin 2, through pin E of the module connector. The B+ to the plate, pin 1, is applied through pin C of the module connector.

c. The mixer tube heterodynes the local oscillator and incoming tuned rf signals. The output on the plate circuit of the tube includes the sum and difference frequencies. The plate circuit consisting of choke A3L2 and capacitor A3C2 attenuates the higher or sum frequency so that only the difference frequency is passed through coupling capacitor A3C4 and pin F of the module to the cabling out through connector A11J3 of the rf tuner assembly.

5–14. Mechanical Filters

a. There are two selective electromechanical filters in the receiver used for controlling bandwidth of the if amplifier. The filters, FL1 and FL2, are coupling elements between the mixer, unit A3, and the if amplifier, unit A5. The selection of the filter is made by front panel BANDWIDTH switch S5. The if signal from connector A11J3 is fed to terminal 12 of the front section of S5–2. With S5 in the 1.5 KC position, the circuit through deck 2 of S5 is completed through terminal 11 of the front section to FL1 to insert the 1.5 kHz filter into the circuit. Trimmer capacitor C11 and capacitor C6 on the input and trimmer capacitor C5 and capacitor C10 on the output of the filter are used to

minimize pass band ripple and to provide tuning for resonance. The filtered if signal from FL1 is fed through terminals 11 and 12 of the rear section of S5–1 to the if amplifier. The input to FL2 is grounded through S5–2 when the BANDWIDTH switch is set to the 1.5 KC position.

b. A similar switching arrangement is used for FL2. When S5 is in the 4 KC position, the if signal is fed through terminals 12 and 1 of the front section of deck 2 to FL2, the 4.0 kHz filter. Capacitors C13 and C8 are on the input to the filter and C7 and C12 are on the output of the filter for resonance and for ripple reduction. When FL2 is inserted into the circuit, the input of FL1 is grounded.

c. The negative dc voltage component used for rf gain control (either manual or AVC) is fed into the grid circuit. This voltage is fed through R10, R11 and R13 to both filters so that the input to the if amplifier is biased to affect amplifier gain.

5–15. IF Amplifier

a. The two-stage if amplifier, unit A5, provides amplification of the if signal. The amplifier is a plug-in module of the open type and uses two 6611 subminiature-type pentode vacuum tubes with double-tuned transformer coupling.

b. Vacuum tube A5V1 is the first amplifier stage. The if signal (with gain control biasing) is coupled directly to the grid (pin 4) through pin D of the module connector. Filament voltage for A5V1 and A5V2 is +1.5 volts and is fed through pin B of the module. The B+ and screen voltage for both tubes is taken from the +45-volt source, fed through pin F of the module. This amplifier is a conventional if amplifier circuit, the output of A5V1 being coupled through A5T1 to the grid of A5V2.

c. The second if amplifier stage, using A5V2, is also a conventional if amplifier circuit. The output of the plate circuit is transformer-coupled through A5T2 and coupling capacitor A5C3 to the if output unit A6 through pin J of the module connector.

5–16. IF Output and Diode Output

a. The if output stage, unit A6, consists of one vacuum tube amplifier stage (A6V1), a solid-state diode output stage that provides the df output and the audio and df diode detectors. The stage consists of a single plug-in module on the if assembly.

b. The amplifier stage, A6V1, is the third if stage. It is a conventional amplifier, with the if input signal direct-coupled to grid 4 of the vacuum tube. B+ voltage for the screen (pin 2) and plate (pin 1) is applied through pin 4 of XA6. The output of A6V1 is taken from the plate circuit to two separate circuits on the module. One is the if signal for the direction-finding diode output circuit, the other is for the audio detector and AVC voltage circuit. The input from the beat frequency oscillator is coupled to the plate circuit of A6V1 through pin 7 of XA6 and capacitor A6C6. In this stage, the bfo signal is mixed with the if frequency (or heterodyned) to obtain a zero beat in dial calibration or it is used to provide audio indication of a cw signal.

c. The df diode output circuit consists of transistor amplifier A6Q1 and emitter follower A6Q2. The output of A6V1 is coupled to the base of A6Q1 through capacitor A6C13. The output of A6Q1 is taken from the collector load resistor A6R8 to the base of A6Q2. The output signal from A6Q2 is taken from resistor A6R11 and is coupled through capacitor A6C10 to a rectifier circuit consisting of A6CR2 and A6CR3. This circuit detects the if signal to produce a negative dc voltage coupled through A6R13 and pin 8 of XA6 to DIODE OUTPUT receptacle J9 on the front panel. The collector voltage for the two transistors is derived from the B+ source to the module through dropping resistor A6R12 and is held constant by zener diode A6CR4.

d. The am diode detector is A6CR1. The if signal from A6V1 is coupled to the detector circuit through capacitor A6C5 which is paralleled by choke coil A6L2. The dc component of the detected signal is coupled through resistor A6R6 and pin 6 of XA6 for AVC inputs to the rf amplifiers and if amplifier when S7 is in the AVC position. The detected signal is further filtered by capacitor A6C8 and resistor A6R4. It is then applied to AF GAIN potentiometer R2 through pin 5 of XA6.

5–17. Audio Frequency Amplifier

a. The audio frequency amplifier consists of one high gain amplification and one driver stage, on a plug-in module, unit A9, on the if assembly. Both amplification stages use subminiature-type pentode tubes.

b. The attenuated demodulated signal from the wiper of AF GAIN potentiometer R2 is coupled to the grid (4) of vacuum tube A9V1 through pin B of XA9 and capacitor A9C7. The output of the high gain amplifier is taken from the plate (1) of A9V1 through coupling capacitor A9C3 and resistor A9R7 to the grid (4) of A9V2.

The driver stage, A9V1, is a 6611 tube. The output of this tube is transformer coupled through A9T1 and pin E of XA9 to the audio output stage with feedback to the grid through resistor A9R2. B+ for both tubes of the module is taken from the +45-volt source through pin C of XA9, the +1.5-volt filament supply for both tubes is through pin A of XA9.

5–18. Audio Output Stage

The audio output stage provides one additional stage of audio amplification so that more than one headset or speaker can be used. The stage consists of power transistor Q1 and associated components built onto the if assembly. The input to the base of Q1 is coupled through resistor R20 and capacitor C23. The output is taken from collector load resistance R18 through coupling capacitor C24 to the front panel AUDIO OUTPUT receptacle J3. The audio output is also fed to pin N of connector J8. This connector mates with connector A10J8 in the housing assembly. The feed from pin N is to pin D of receptacle A10J4 in the battery compartment so that external headsets or speakers can be connected to the receiver's audio output.

5–19. Calibration Oscillator

a. The calibration oscillator, unit A7, is a plug-in module on the if assembly. The oscillator performs the function of: (1) supplying a 200 kHz fundamental frequency for dial calibration in bands 1, 2 or 3; (2) supplying a 1 mHz fundamental frequency for dial calibration in band 4 or 5; and (3) supplying a bias voltage for manual gain control operations when the receiver is in the am or cw mode. The functioning of the oscillator is set by the positions of the FUNCTION switch S2 and the BAND switch A11S1.

b. Figure 5–3 is a simplified schematic showing the operation of unit A7 as a 200 KHz oscillator for dial calibration in frequency bands 1, 2 and 3. The actual oscillator circuit makes use of the grid (4) and the screen (2) of A7V1 so that the oscillator functions as a triode with the screen acting as the triode plate. The plate (1) of A7V1 is electron-coupled to the screen so that oscillator output can be taken from the plate circuit. By the positions of FUNCTION switch S2 and BAND switch A11S1–9, the 200 kHz crystal A7Y1 is connected in the grid circuit to maintain the fundamental frequency. The screen is tuned by a tank circuit consisting of coil A7L1, resistor A7R7, and capacitor A7C1. This circuit is tuned to the 200 kHz crystal frequency. The output of the plate of A7V1 is taken through S2–1 and coupling capacitor C4 to the input coupling capacitor C3 of the antenna circuit for introduction into the rf tuner.

c. Figure 5–4 is a simplified schematic showing the operation of unit A7 as a 1 mHz oscillator for dial calibration in frequency bands 4 and 5. The oscillator operation is similar to that of the 200 kHz operation. The major differences include the switching of the 1 mHz crystal A7Y2 into the grid circuit of A7V1 and the connection of an additional capacitor A7C3 across the screen tank circuit. This additional capacitor tunes the tank circuit so that the screen load is only that of R2. The output of the 1 mHz oscillator is from the plate as with the 200 kHz oscillator operation.

d. Figure 5–5 is a simplified schematic diagram showing the operation of unit A7 as a bias source for manual rf gain control. With FUNCTION switch S2 in the AM or CW position, transformer A7T1 is connected between the grid (4) and the plate (1) of A7V1. This completes a feedback path to have the tube function as an audio oscillator. The feedback path between the screen (2) and the grid used for 200 kHz or 1 mHz oscillation is disabled so that the tube is operating essentially as a triode oscillator. The frequency of oscillation is set by the values of capacitor A7C6 and the inductance of the grid circuit winding transformer A7T1. This oscillation frequency is approximately 12 kHz. In this mode of operation, a negative grid bias voltage is developed which appears across grid resistors A7R4 and A7R5 in series with the rf gain potentiometer R3 winding. Filtering of this voltage by capacitors A7C9 and A7C10 (in conjunction with resistor A7R5) provides an essentially smooth negative dc voltage at the winding of R3. This voltage is the bias voltage applied to the rf amplifiers and if amplifier for manual gain control.

5–20. Harmonic Generator

The harmonic generator consists of diode CR1 and resistor R14 in parallel. The parallel connection is across the output of the calibration

Figure 5–2①. Schematic Diagram, Radio Receiver R–901/GR (sheet 1 of 3).
(Located in back of manual)

Figure 5–2②. Schematic diagram, radio receiver R–901/GR. (sheet 2 of 3).
(Located in back of manual)

Figure 5–2③. Schematic diagram, radio receiver R–901/GR. (sheet 3 of 3).
(Located in back of manual)

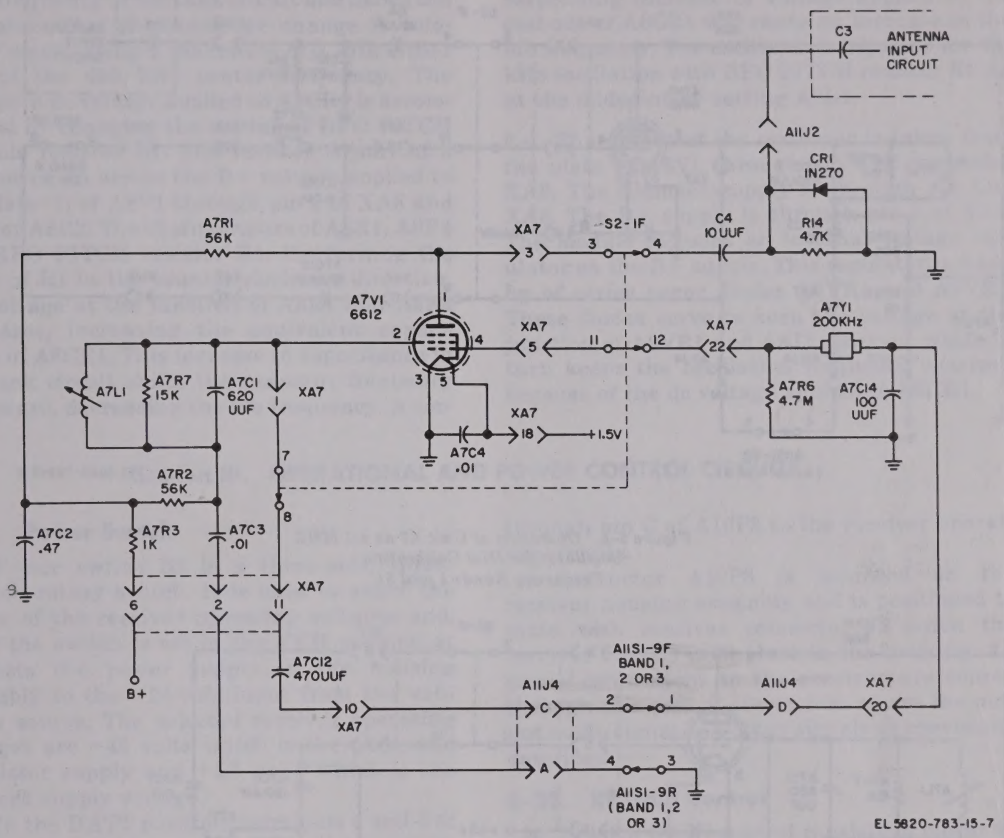

Figure 5-3. Operation of Unit A7 as a 200 kHz Oscillator for Dial Calibration (Frequency Bands 1, 2, and 3).

oscillator in the 200 kHz or 1 mHz mode of operation. It is shorted out with FUNCTION switch S2 in the AM or CW position. The diode clips the fundamental waveform out of the calibration oscillator coupled through capacitor C4. This clipping action distorts the fundamental waveform generating harmonics of the fundamental 200 kHz or 1 mHz frequency. These harmonics produce a wide spectrum of the harmonic frequencies coupled back into the antenna circuit.

5-21. Beat Frequency Oscillator

a. The beat frequency oscillator, unit A8 is a shielded plug-in module on the if assembly. The unit provides a variable frequency signal in the range of 455 ± 3 kHz that is beat against the if signal in the if amplifier to generate an audible signal in the audio stages. The variable bfo operates when FUNCTION switch S2 is in the CW or CAL position. Oscillation frequency is set by BFO PITCH variable resistor R1.

b. The beat frequency oscillator is a modified Hartley oscillator circuit. The oscillator tube A8V1 is a subminiature 6611 pentode. The tank circuit to maintain oscillation consists of inductance A8L1 and capacitors A8C9 and A8C1 in parallel. Coupling is through diode A8CR1. The diode presents an equivalent capacitance across the tuned circuit at the resonant frequency range of 455 kHz. The connection of the diode in the circuit presents an equivalent resistance high enough to have a negligible effect on the circuit performance.

c. The equivalent capacitance of diode A8CR1 changes with the dc voltage applied to it. By changing the dc voltage, the equivalent capacitance changes which in turn changes the reso-

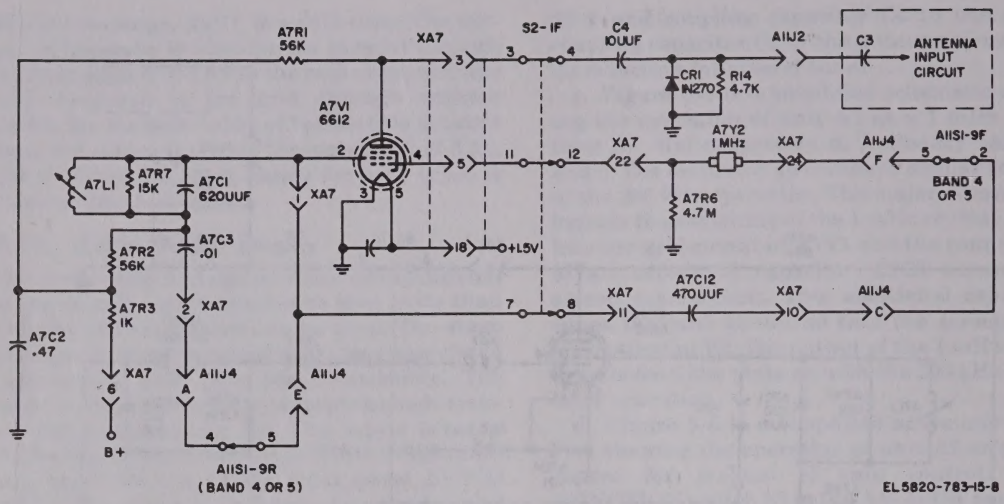

Figure 5-4. Operation of Unit A7 as a 1 MHZ Oscillator for Dial Calibration (Frequency Bands 4 and 5).

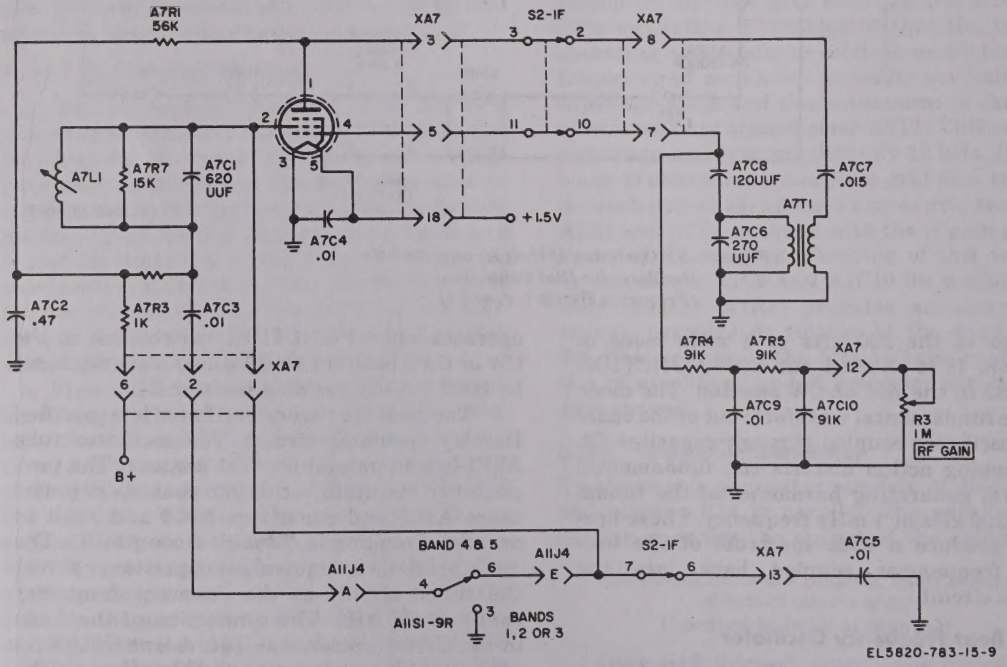

Figure 5-5. Operation of Unit A7 as a Bias Source for Manual RF Gain Control

nant frequency of the tank circuit and hence the oscillator. The bfo frequency change is relatively small, being a maximum of 3 kHz either side of the 455 kHz center frequency. The change in dc voltage applied to A8CR1 is accomplished by changing the setting of BFO PITCH variable resistor R1. The resistor is part of a resistor chain across the B+ voltage applied to the plate (1) of A8V1 through pin 2 of XA8 and resistor A8R2. The chain consists of A8R1, A8R4 and BFO PITCH resistor R1. By turning the wiper of R1 in the counter-clockwise direction, the voltage at the junction of A8R1 and A8R4 decreases, increasing the equivalent capacitance of A8CR1. This increase in capacitance in the tank circuit shifts the resonant frequency downward, decreasing the bfo frequency. A corresponding increase of voltage applied to the cathode of A8CR1 will cause an increase in the bfo frequency. The oscillator is adjusted for 455 kHz oscillation with BFO PITCH resistor R1 set at the midpoint by setting A8L1.

d. The output of the oscillator is taken from the plate of A8V1 through pin 4 of connector XA8. The filament supply is through pin 1 of XA8. The B+ supply is through pin 2 of XA8. The module includes an internal voltage regulator on the B+ supply. This regulator is made up of series zener diodes A8VR1 and A8VR2. These diodes serve to keep the voltage at the junction of A8VR1 and A8J1 constant which in turn keeps the oscillation frequency constant because of the dc voltage applied to A8CR1.

Section III. OPERATIONAL AND POWER CONTROL CIRCUITS

5–22. Power Switch

a. Power switch S3 is a three-pole, three-position rotary switch. It is used to select the source of the receiver operating voltages and, when the switch is set in the VEH position, it connects the power supply in the housing assembly to the +24-volt input from the vehicular source. The selected receiver operating voltages are +45 volts which is the plate and transistor supply and +1.5 volts which is the filament supply voltage.

b. In the BATT position, terminals 4 and 5 of the switch make up a closed circuit to provide +45 volts from pin 3 of +45-volt battery connector A10P1 through pin B of connector A10P8 and S3 to the remainder of the receiver. Also in this position of S3, terminals 7 and 8 make up a closed circuit for the filament supply from pin 2 of +1.5-volt battery connector A10P2 through pin F of connector A10P8 to the remainder of the receiver.

c. In the OFF position, all three poles of S3 are open, cutting off both plate and filament supply voltages.

d. In the VEH position of S3, terminals 2 and 3 make up a closed circuit to apply +24-volts from pin A of battery compartment receptacle A10J4 through pin L of connector A10P8, fuse F1, switch S3 and pin H of A10P8 to the power supply in the housing assembly. Also, terminals 5 and 6 complete the circuit to patch the +45-volt output of the power supply through pin A of A10P8 to the receiver operating circuits and terminals 8 and 9 of S3 complete the circuit to connect the +1.5-volt output of the power supply through pin C of A10P8 to the receiver operating circuits.

e. Connector A10P8 is mounted on the receiver housing assembly and is positioned to mate with receiver connector J8 when the receiver chassis is in place in the housing. All power connections to the receiver are routed through this pair of connectors as are the output audio signal and other signals as previously described.

5–23. RF Gain Control

a. The RF GAIN control consists of mechanically coupled potentiometer R3 and switch S7. In the extreme clockwise position of the RF GAIN control, switch S7 is closed so that the signal out through the arm of the switch is from the AVC output of if output unit A6. In any other position of the control, the output through the arm of S7 is from the wiper of potentiometer R3. The RF GAIN control adjusts the amplification of the first and second rf amplifiers and of the if amplifier stages.

b. The adjustment of amplifier gain is made by changing the dc bias voltage applied to the grid return paths of the amplifier tubes. The grid return paths are all decoupled from each other by the network made up of A11C37, C9, R11, R12, C16 and R13. They are collectively fed to the arm of switch S7. With manual gain control, the negative dc output of the calibration oscillator is taken from the wiper of potentiometer R3 and applied to the grid return paths of the tubes. As the RF GAIN control is turned clockwise, the wiper of R3 moves closer to

ground, applying a smaller dc voltage thereby increasing receiver sensitivity. With the RF GAIN control in the full clockwise position, the input to the arm of S7 is the AVC voltage developed in unit A6, automatically controlling the receiver sensitivity.

5-24. FUNCTION Switch

a. FUNCTION switch S2 is a three-section, two-wafer, three-position rotary switch. Section 1F switches the calibration oscillator functions as described in paragraph 5-19. Section 2F switches the beat frequency oscillator off or on and simultaneously switches the AVC output on or off and enables or disables the meter circuit to read signal level. Section 2R enables or disables the harmonic generator on the calibration oscillator output.

b. With S2 in the AM position, section 1F connects the calibration oscillator to function as a bias supply as shown in figure 5-5. Terminals 8 and 9 of section 2F completes the circuit from the screen (2) of if amplifier tube A5V1 to the METER switch S4. Terminals 11 and 12 of section 2R short circuit the harmonic generator.

c. When S2 is in the CW position, section 1F connects the calibration oscillator to function as a bias supply as shown in figure 5-5. This is substantially the same switching configuration as with S2 in the AM position. The CW position of FUNCTION switch S2 also enables the beat frequency oscillator by switching on the filament supply to A8V1 through terminals 1 and 2 of section 2F. The connection from the screen of if amplifier tube A5V1 to the METER switch is opened in this position so that meter readings of relative signal level can not be made. Section 2R shorts circuits the harmonic generator.

d. When S2 is in the CAL position, section 1F connects the calibration oscillator to function as either a 200 kHz oscillator or a 1 mHz oscillator, depending upon the BAND SWITCH settings. These oscillator connections are indicated in figures 5-3 and 5-4. Section 2F connects the plate and screen voltage from unit A5 to the METER switch S4 through terminals 6 and 7, and energizes the beat frequency oscillator by switching on the +1.5-volt filament supply through terminals 2 and 3. Section 2R removes the short circuit from the harmonic generator so that dial calibration can be performed.

5-25. BAND WIDTH Switch S5

a. This is a two-wafer, four-section, two-position rotary selector switch. It provides the means for switching one of the two mechanical filers, FL1 or FL2, into the if signal path.

b. In the 1.5 KC position of S5, the incoming if signal from connector A11J3 is routed through terminals 11 and 12 of section 2F to the input terminal 1 of FL1. Terminals 11 and 12 of section 1R route the output signal from terminal 6 of FL1 to the if amplifer unit A5. Terminals 1 and 2 of section 1F short circuit the output of FL2 and terminals 1 and 2 of section 2R ground the input terminal of FL2.

c. In the 4 KC position of S5, the incoming if signal from conector A11J3 is routed through terminals 12 and 1 of section 2F to the input terminal 1 of FL2. Terminals 1 and 12 of section 1R route the output signal from terminal 6 of FL2 to the if amplifier unit A5. Terminals 11 and 2 of section 1F short circuit the output of FL1 and terminals 11 and 2 of section 2R ground the input terminal of FL1.

5-26. AF GAIN Control

The AF GAIN control is potentiometer R2 on the front panel. The winding of R2 is connected to the diode output of unit A6. The wiper of R2, picking up a portion of the detected signal, is connected to the input grid of audio frequency amplifier unit A9 through coupling capacitor A9C7.

5-27. METER Switch

a. METER switch S4 is a two-pole, four-position rotary selector switch. The switch selects the input to panel meter M1. The meter is a 1-milliampere dc milliammeter.

b. In the A+ position, meter M1 indicates a reading proportional to the receiver filament supply voltage. The meter terminals are connected to ground through S4 terminals 8 and 6 and to the filament supply resistor R8 through S4 terminals 9 and 1. Resistor R8 is the meter multiplier for the +1.5-volt input and its value is selected to provide deflection in the "good" range for +1.5 volts.

c. In the B+ position, meter M1 indicates a reading proportional to the receiver plate supply voltage. The negative side of the meter is connected to ground through terminals 8 and 6 of S4. The positive side of the meter is connected to +45-volt multiplier resistor R6 through terminals 10 and 1 of S4.

d. In the VEH position, meter M1 indicates a reading proportional to the vehicular battery voltage applied to the receiver. The negative side of the meter is connected to ground through terminals 8 and 6 of S4. The positive side of the

meter is connected to the +24-volt input multiplier resistor R7 through terminals 11 and 1 of S4.

e. In the SIG position, meter M1 indicates a reading proportional to signal level dc, which is proportional to AVC voltage output of the screen (2) of if amplifier tube A5V1. This reading represents approximate incoming signal strength. The deflection of the meter results from the increase or decrease in plate voltage of A5V1 as AVC voltage is applied to the grid circuit of the tube. The positive terminal of the meter is connected to the screen of A5V1 through terminals of FUNCTION switch S2 and resistor A5R9 by means of terminals 12 and 1 of S2. The negative terminal of meter M1 is connected to the wiper of zero adjustment potentiometer R4 through terminals 7 and 8 of S2. With zero input signal, the adjustment of R4 balances the screen voltage by picking off a portion of the +45-volt plate supply applied across the voltage divider made up of R5, R4 and R9 so that the meter deflection is zero.

5–28. Power Supply

a. The vehicular power supply is part of the housing assembly unit A10. This power supply is a dc-to-dc converter, providing +45 volts and +1.5 volts for the receiver when the receiver is operated from the +24-volt vehicular battery. The power supply is shown schematically in figure 5–2.

b. The nominal +24-volts input is applied to the power supply through pin H of connector A10P8. This input is filtered through A10FL1 and the associated filter capacitors and diode A10CR1. It is regulated by series regulator A10Q1 and A10Q2. The level of the output voltage is sensed by the pickoff of the arm of A10R5 which is a potentiometer in the voltage divider made up of resistors A10R4, A10R5 and A10R6. This voltage is applied to the base of A10Q3 which acts as a differential amplifier, applying a corrective signal to the series regulator. Zener diode A10CR2 clamps the emitter of A10Q3 to a fixed potential above ground to make A10Q3 act as a differential amplifier.

c. The regulated voltage is applied to a solid state inverter made up of transistors A10Q4 and A10Q5 and transformer A10T1. These components make up a square wave oscillator applying the square wave to the primary of A10T1. Transformer coupling between primary winding 1–2–3 and winding 4–5–6 of the transformer provide the switching pulses back to the emitters of A10Q4 and A10Q5 to cause the square wave oscillations. Capacitors A10C11 and A10C12 provide tuning of the oscillator.

d. The transformer coupling of A10T1 provides an almost sinusoidal waveform appearing at secondaries 7–8 and 9–10–11 of transformer A10T1. Winding 7–8 feeds a full-wave bridge rectifier made up of A10CR3 through A10CR6. The output of this bridge provides +45 volts through a filter made up of A10C2, A10R9, A10R10, A10C3, A10C4, A10L3 and A10C17. Variable resistor A10R10 allows exact setting of the plate voltage value. Winding 9–10–11 of A10T1 and diodes A10CR7 and A10CR8 make up a center-tapped full wave rectifier. The +1.5-volt output of this circuit is filtered and fed out through pin C of A10P8.

CHAPTER 6

DIRECT SUPPORT MAINTENANCE

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

CAUTION

During dynamic test procedures used as part of the troubleshooting techniques the receiver and its internal power supply are energized with internal components exposed. Voltages present in the test equipment and at exposed internal terminals can destroy delicate parts such as the 1.5-volt subminiature tube filaments, and transistors. Use care when taking internal measurements or when connecting test equipment to internal test points. Use insulated leads with only test probes or clips exposed for all jumpers and test leads.

6-1. General Instructions

Troubleshooting at direct support maintenance level includes the techniques for operator and organizational maintenance given in Chapter 4 and any special or additional techniques required to isolate a defective module or subassembly. The direct support maintenance procedures are not complete in themselves, but supplement the procedures described in organizational maintenance (ch 4). The systematic troubleshooting procedure that begins with the operational and sectionalizing checks that can be performed at an organizational level must be completed by means of localizing and isolating techniques. Section II describes intraunit (within the unit) localizing and isolating techniques that must be performed at the direct support maintenance level.

6-2. Troubleshooting Procedures

a. General. The first step in servicing a defective Radio Receiver R-901/GR is to sectionalize the fault. Sectionalizing means tracing the fault to a major subassembly responsible for abnormal operation. The second step is to localize the fault to a defective plug-in module or circuit component of a subassembly responsible for abnormal operation. Some faults can often be localized by sight, smell or hearing. These would include, *for example*, burned out resistors or capacitors, broken connector pins, damaged printed circuit cards, internal arcing, and shorted transformer windings. The majority of faults, however, must usually be localized by checking voltage and resistance.

b. Sectionalization. Listed below are a group of tests arranged to reduce unnecessary work, and to aid in tracing trouble in a defective receiver. The first step is to locate the subassembly or major chassis at fault by the following methods:

(1) *Visual Inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits. All meter readings or other visual signs should be observed and an attempt made to sectionalize the fault to a particular circuit or plug-in module.

(2) *Operational Tests.* Operational tests often indicate the general location of trouble within the receiver. In many cases, the tests themselves will help in determining the exact nature of the fault. The check list given in paragraph 4-7 is a good operational test.

c. Localization. The tests listed below will aid in isolating the trouble. First, localize the trouble to a single stage or circuit. Secondly, isolate the trouble to a particular module or replaceable component by voltage, resistance and continuity measurements. Use the following methods of trouble localization:

(1) *Voltage and resistance measurements.* These measurements will help locate a defective module or circuit component part at fault. Follow the procedures of paragraph 6-4 in performing the voltage and resistance measurements.

(2) *Troubleshooting chart.* The trouble symptoms listed in the chart (see paragraph 6-8) will aid in localizing trouble to a module or particular circuit.

(3) *Stage-gain charts.* Stage-gain charts (see

para 6-10) are of use in localizing hard-to-find troubles in individual stages or modules.

(4) *Intermittent troubles.* In all testing, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble can be made to appear or disappear in many cases by tapping the chassis, jarring the receiver, or by wiggling internal harnesses. Always check internal wiring and connections to plug-in units and discrete components mounted in accessible areas.

(5) *Signal substitution.* Signal substitution procedures (para 6-9) enable a repairman to localize trouble quickly to a particular stage of the receiver. Test equipment for signal substitution usually includes a signal generator (rf), an audio oscillator, and a vacuum tube voltmeter or equivalent. An oscilloscope may also be used for waveform checks if desired.

6-3. Test Equipment Required

The following chart lists test equipment required for troubleshooting Radio Receiver R-901/GR. Also listed in the chart are the assigned common names of the equipment as used in this chapter.

Test Equipment	*Technical Manual*	*Common Name*
Signal Generator Set, RF AN/URM-25	TM 11-5551	RF Signal Generator
Output Meter TS-585B/U	TM 11-5017	Output Meter
Multimeter ME-26B/U	TM 11-6625-200-15	AC VTVM
Multimeter ME-30/U	TM 11-6625-320-12	DC VTVM
Test Set, Electronic Tube TV-7D/U	TM 11-6625-274-12	Tube Tester
Attenuator HP 355B* (20 db)		Attenuator
Signal Generator HP 200C D*		Audio Oscillator
Counter, Electronic Digital Readout AN/USM-207	TM 11-6625-700-10	Digital Counter
Cable Assembly, Special Purpose, Electrical CX-11954/GR		Extender Cable
Card Extender, Printed Circuit		Card Extender
Tool Kit, Electronic Equipment TK-100/GR	SM 11-4-5180-R13	Tool kit (hand tools)

*Commercial Nomenclature

Section II. UNIT TROUBLESHOOTING PROCEDURES

6-4. Voltage and Resistance Measurements

a. Setup. In order to make voltage and resistance measurements of the receiver, the receiver must be removed from the case (housing assembly). The receiver is reconnected to the case using the extender cable. A +24-volt source is required for voltage measurements, the source being connected to receptacle J4 in the battery compartment with the positive input to pin A of J4 and the negative input or ground to pin D of J4. Measurements of the rf modules are made easier by using the card extender. To make the voltage or resistance measurements of unit A1, A2, A3 or A4, remove the module from its connector, insert the extender card and reconnect the module to the extender card. To make voltage or resistance measurements of if and other modules, remove the shield or can on the module. Replace each removed shield or can before taking measurements of another module.

b. Switch Positions. All voltage and resistance measurements are made with the front panel controls of Radio Receiver R-901/GR in the positions tabulated below.

Control	*Setting*
FUNCTION	AM
BANDWITH	4 KC
BAND SWITCH	3
ANT TRIM	MIDPOINT
AF GAIN	MAXIMUM
RF GAIN	MAXIMUM
BFO PITCH	0
METER	FIL
POWER:	
voltage measurement	VEH
resistance measurement	OFF

c. Measurements. Table 6-1 lists the voltage and resistance measurements of the units contained in Radio Receiver R-901/GR.

NOTE

All voltage measurements made with dc vacuum tube voltmeter. All resistance measurements made with ohmmeter having maximum output voltage of +1.5 volts. Use only equivalent instruments to prevent false readings or damage to internal components.

Table 6-1. Voltage and Resistance Measurements

Receiver Unit	Pin Number	Voltage (in volts)	Resistance (in ohms)
1st RF Assembly Unit A1 A1V1	1	41	15K
	2	33	30K
	3	0	0
	4	−0.6	2.8M
	5	1.4	2.0
A1XA1	A	1.4	2.5
	B	0	1.5 K
	C	−0.3	400K
	D	0	0
	E	41	15K
	F	41	15K
2nd RF Assembly Unit A2 A2V1	1	42	15K
	2	30	65K
	3	0	0
	4	−0.4	5.0M
	5	1.4	2.5
A2XA2	A	1.4	2.0
	B	40	15K
	C	−0.2	400K
	D	0	0
	E	42	15K
	F	42	15K
Mixer Assembly Unit A3 A3V1	1	43	15K
	2	26	115K
	3	0	15K
	4	−0.3	5.0M
	5	1.4	3.0
A3XA3	A	1.4	2.5
	B	−0.3	5.0M
	C	43	15K
	D	0	0
	E	0	50
	F	NC	NC
Oscillator Assembly Unit A4 A4V1	1	39	15K
	2	39	15K
	3	0	0
	4	−2.0	26K
	5	1.3	3.0
A4XA4	A	1.4	3.0
	B	0	Infinity
	C	0	0
	D	0	0
	E	43	15K
	F	NC	NC
IF Amplifier Assembly Unit A5 A5V1	1	30	40K
	2	30	40K
	3	0	0
	4	−0.35	4.0M
	5	1.45	2.5
A5V2	1	43	15K
	2	30	70K
	3	0	0
	4	−0.25	5.0M
	5	1.45	2.5
A5XA5	A	0	0
	B	1.45	2.5
	C	NC	NC
	D	−0.35	4.0M
	E	30	70K
	F	43	15K
	H	NC	NC
	J	−0.3	5.0M
IF Output Assembly Unit A6 A6V1	1	43	15K
	2	35	70K
	3	0	0
	4	−0.5	4.7M
	5	1.45	2.5
A6Q1	base	2.7	5K
	collector	7.0	12K
	emitter	1.7	700
A6Q2	base	15	12K
	collector	15	9K
	emitter	6.2	4.3K
A6XA6	1	−0.3	4.7M
	2	0	0
	3	1.45	2.5
	4	43	15K
	5	−0.1	300K
	6	−0.1	1.0M
	7	0	Infinity
	8	−3.0	Infinity
	9	43	15K
AF Amplifier Assembly Unit A9 A9V1	1	7.0	500K
	2	13	1.0M
	3	0	0
	4	0	4.7M
	5	1.45	2.5
A9V2	1	38	22K
	2	38	22K
	3	0	0
	4	0	2.2M
	5	1.45	2.5
A9XA9	A	1.45	2.5
	B	0	300K
	C	4.3	15K
	D	NC	NC
	E	0	50
	F	0	0
BFO Assembly Unit A8 A8V1	1	25	15K
	2	25	15K
	3	0	0
	4	0	0
	5	0	60
A8XA8	1	0	60
	2	43	15K
	3	NC	NC
	4	0	Infinity
	5	0	Infinity
	6	NC	NC
	7	5.5	10K
CAL OSC Assembly Unit A7 A7V1	1	0	23

Receiver Unit	Pin Number	Voltage (in volts)	Resistance (in ohms)
	2	32	75K
	3	0	0
	4	−13	1.0M
	5	1.45	2.5
A7XA7	1	30	75K
	2	0	0
	3	23	75K
	4	NC	NC
	5	−13.5	1M
	6	43	15K
	7	−13.5	1.0M
	8	23	75K
	9	NC	NC
	10	0	Infinity
	11	0	Infinity
	12	11.5	1.0M
	13	32	75K
	14	0	0
	15	NC	NC
	16	NC	NC
	17	NC	NC
	18	1.5	2.5
	19	NC	NC
	20	0	Infinity
	21	NC	NC
	22	0	5.0M
	23	NC	NC
	24	0	Infinity
	25	0	0
Power Supply Assembly Unit A10	C1	24	6.0
	C14	1.5	7.0
	C18	43.5	50
T1	1	17	30
	2	17	30
	3	17	30
	4	24	1.5
	5	24	2.0
	6	24	1.5
	7	23	6.0
	8	23	6.0
	9	0	0
	10	0	0
	11	0	0

6–5. Check of Receiver Filament and B+ Circuits for Shorts

a. When to Check. When abnormal symptoms reported from operational tests indicate possible trouble in filament or B+ circuits.

b. Conditions of Tests. To prepare for short circuit tests, set up the receiver using procedures given in paragraph 6–4*a* except power is not to be applied to the rear connector J4. The extender cable is connected between connectors A10P8 in the housing assembly and J8 on the back of the panel and chassis assembly (fig 6–1). In addition, set the front panel switches to the following positions:

(1) DIAL LIGHT switch of OFF position.

(2) FUNCTION switch to CAL position.

(3) POWER switch to VEH position.

(4) METER switch to VEH position.

(5) BFO PITCH control to extreme positive position (clockwise).

c. Measurements. Make the resistance measurements indicated below. If abnormal results are obtained, make the additional isolating checks outlined directly under each indicated measurement. When the faulty part is found, remove and replace before applying power to the receiver.

CAUTION

Ohmmeter voltages, particularly the lower scales (RX1, etc.) may destroy delicate vacuum tube filament if the test leads are inadvertently placed on the wrong test points.

d. Short Circuit Measurements.

(1) *B+ Shorts.* Connect the multimeter (on ohms scale) to junction of resistor R5 and R6 on the chassis and to any convenient ground point on the chassis. Note meter reading. Meter reading should be 60K ohms ±10%. If meter reading is higher than 60K ohms, check for an open circuit in the bleeder circuit of BFO plug-in unit A8 including BFO PITCH potentiometer R1 on the front panel. If meter reading is less than 60K ohms, a short circuit exists and must be localized. To localize, proceed as in step (2) below.

NOTE

If receiver B+ circuits are functioning properly, the meter reading should increase from 60K ohms to 300K ohms upon removal of BFO plug-in unit A8.

(2) *Module Shorts.* Disconnect plugs and modules in order listed below and observe ohmmeter readings. When the meter swings to 60K upon disconnection of plug or removal of module a short circuit exists within the item just disconnected or removed. Reconnect or replace item if the meter reading does not change.

Remove	*Defective Component*
Connector A11P5	RF tuner chassis and/or plug-in units A1, A2, A3, or A4
Connector A10P8	Power supply and/or meter circuit including S4
Plug-in units A1, A2, A3, A4, A5, A6, A7, A8, and A9 (one at a time)	Plug-in module just removed

NOTE

If the short circuit is not removed by removal of all plug-in modules and opening of the connectors, check all chassis components of the audio stage including transistor Q1, resistors R16, R17, R18, and R19, and filter capacitors of the power supply.

(3) *Filament Supply Shorts.* Connect the multimeter (on RX1 scale) to B+ side of resistor R8 and to a convenient chassis ground. The positive side of R8 is the end of the resistor opposite to that connected to terminal 9 of METER switch S4. Remove all plug-in units one at time observing the meter reading. Do not reinsert the units until the test is completed. When meter reading shows a large increase in resistance the short circuit is in the plug-in unit just removed. If meter reading does not change noticeably for all plug-in modules removed, the short circuit is in the cable assembly, the receptacles for plug-in modules or in the power supply.

6–6. Power Supply Checks

When abnormal symptoms reported from operational tests indicate possible power supply trouble, make specific resistance measurements as in table 6–1. When the fault is isolated, replace the defective component before using the power supply with vehicular power input.

CAUTION

The transistors of the power supply may be destroyed by applying ohmmeter test leads to the wrong test points or with the wrong polarity.

6–7. Test Setup

Troubleshooting, signal substitution, and other bench tests require connection to a power supply source and to various test instruments. The power source connection can remain as originally made to the receiver for most tests; the test equipment connections will vary depending upon the test to be performed. Connect the test setup for the receiver as described below:

a. Power Connections

(1) Unless it is known to be malfunctioning, the internal power supply with a 24-volt input to the rear connector A10J4 (in the battery compartment) is the most convenient source. Connect the power connections as described in paragraph 6–4*a*.

(2) If the power supply is known to be malfunctioning, the batteries normally used for man-portable operation of the receiver are the most convenient power source for bench tests. To test the receiver using one battery BA–403/U and one BA–418/U proceed as follows:

(*a*) Install batteries using procedures of paragraph 2–3*b*.

(*b*) Loosen front panel securing screws and remove the receiver from the case.

(*c*) Install the extender cable between receptacle A10P8 in the case and connector J8 on the rear of panel and chassis assembly.

(3) If the internal power supply is known to be malfunctioning and batteries are not available, use an equivalent power source or sources capable of supplying 1.25 to 1.5 volts at 450 milliamperes and 45 volts at 30 milliamperes. To connect these inputs to the receiver, proceed as follows:

(*a*) Remove the receiver from the case by loosening the front panel retaining screws and sliding the receiver forward and free of the case.

(*b*) Energize 1.5-volt nominal supply and set for 1.5 ±0.1 volts output using accurate dc voltmeter.

(*c*) Deenergize the 1.5-volt power supply.

(*d*) Energize the 45-volt nominal power end set for 45-volt output using accurate dc voltmeter.

(*e*) Deenergize the 45-volt supply.

(*f*) Insure that the POWER switch on the front panel of the receiver is in the OFF position.

(*g*) Connect the 1.5-volt supply with the positive (+) lead to pin A of connector J8 or to terminal 6 of switch S3 on the receiver and the negative (−) lead to pin K of J8 or to a convenient chassis connection point on the receiver.

(*h*) Connect the 45-volt supply with positive (+) lead to pin H of connector J8 or to terminal 2 of switch S3 on the receiver and negative (−) lead to pin K of J8 or to a convenient chassis connection point on the receiver.

(*i*) Energize power supplies.

(*j*) To energize the receiver, place POWER switch to VEH position.

b. Test Instruments. Connect test instruments as indicated in figure 6–1.

6–8. Localizing Troubles

a. General. Procedures are given in the trouble charts, table 6–2, for localizing troubles in the receiver. Depending upon the nature of the operational trouble symptom, one or more of the localizing procedures will be necessary to deter-

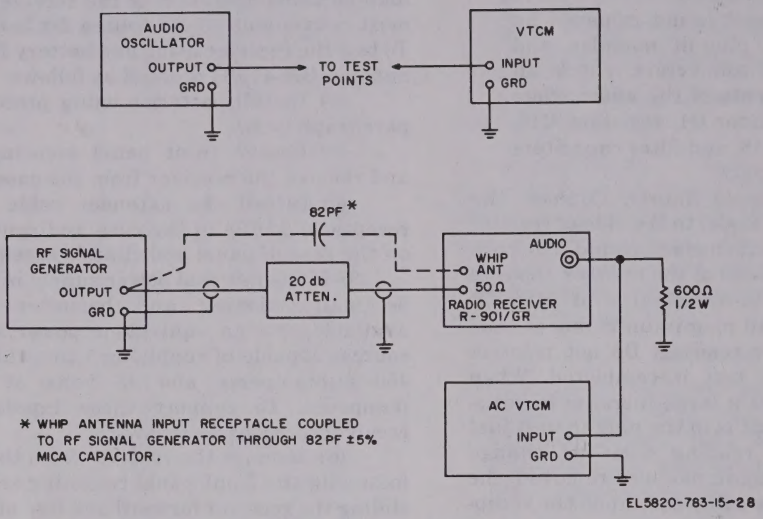

Figure 6–1. Test Setup, Radio Receiver R–901/GR.

mine the defective unit or units. Best use of the troubleshooting chart can be made when the trouble symptoms have been identified by use of the operational checks detailed in paragraph 4–7.

CAUTION

If operational symptoms are not known or if the performance of the operational check list indicates the possibility of internal short circuits, perform the short circuit tests of paragraph 6–5 before applying any power to the receiver or its internal units.

b. Test Setup. The test setup for both power connections and instrumentation for all troubleshooting operations should be in accordance with paragraph 6–7. Trouble symptoms are given in table 6–2 for cases of either operation from batteries or internal power supply with a 24-volt input. If bench supplies are used for 45-volt and 1.5-volt sources, disregard those items having to do with either battery or power supply.

c. Initial Switch and Control Positions. Before starting troubleshooting localization procedures, set all front panel controls to extreme counterclockwise position and all switches except POWER switch and DIAL LIGHT switch to extreme left (counterclockwise) position. Set POWER switch to OFF position and DIAL LIGHT switch to OFF position. Operate switches and controls as indicated in chart during localization operations.

Table 6–2. Troubleshooting Chart

Item	*Indication*	*Probable Trouble*	*Procedure*
1	POWER switch to either VEH or BAT as applicable DIAL LIGHT switch to ON. All filaments and dial light do not light	Short circuit in filament circuit	Check for short circuit per para. 6–5
		If on batteries; Battery BA–403/U improperly connected or defective battery cable or connector A10P2	Check cable and connector
		Battery BA–403/U defective	Check battery
		If on internal power supply: Wiring harness in receiver defective or improperly connected	Check wiring harness
		Power supply defective	Check power supply
		Connector A10J4 defective	Check connector

Item	Indication	Probable Trouble	Procedure
2	Set METER switch to A+ position, meter does not indicate "GOOD"	Defective meter	Check meter M1
		Defective METER switch S4 or resistor R8	Check switch and resistor
		If on batteries, BA–403/U is defective	Check for output voltage of at least +1.25 volts with 500 ma load
		If on internal power supply, power supply is defective	Check power supply
3	Set METER switch to B+ position, meter does not indicate "GOOD"	Defective meter	Check meter M1
		Defective METER switch S4 or resistor R6	Check switch and resistor
		Short in receiver B+ circuits	Check for short circuit per para 6–5
		If on batteries: Battery BA–418/zu improperly connected or defective battery cable or connector A10P1	Check cable and connector
		Battery BA–418/U defective	Check for output voltage of at least +44 volts with 30 milliampere load
		If on internal power supply, power supply defective	Check power supply
4	If on internal power supply, set METER switch to VEH position; meter does not indicate "GOOD"	Defective meter	Check meter M1
		Defective METER switch S4 or resistor R7	Check meter switch and resistor
5	Set RF GAIN and AF GAIN controls both to maximum clockwise position, set FUNCTION switch to CAL position, connect 600-ohm headset to AUDIO receptacle, turn TUNING control through entire frequency range, reset BAND switch and repeat tuning to cover all bands; no tone heard in headset at calibration points and no noise in headset, but meter deflects.	Headset or AUDIO receptacle J3 defective	Check headset and receptacle
		Audio output stage defective	Check by substitution
		Audio amplifier A9 defective	Check by substitution
		AF GAIN control potentiometer R2 defective	Check potentiometer
		FUNCTION switch S2 defective	Check switch
6	Same as item 5 above except that noise is heard in headset	BFO unit A8 defective	Check by substitution
		RF amplifier unit A1 or unit A2 is defective	Check amplifiers by substitution
		FUNCTION switch S2 defective	Check switch
		Calibration oscillator unit A7 defective	Check oscillator by substitution
		RF GAIN control R3 and S7 defective	Check potentiometer and switch
7	Insert amplitude modulated rf signal at 50 OHM connector, set FUNCTION switch to AM position, tune TUNING dial and set BAND switch to pick up injected signal, turn METER switch to SIG position; no meter deflection and no tone in headset	50 OHM receptacle J2 defective	Check connector
		ANTENNA switch S1 defective	Check switch

6–9. Signal Substitution

a. General. Signal substitution procedures are used to isolate defective signal stages of the receiver. An externally-generated signal is substituted for the signal normally present at the input to each stage. Normal operation of the stage receiving the injected signal is indicated if the proper output signal of the stage is developed. The test equipment required for the signal substitution tests described below in *c* through *e* is listed in paragraph 6–3. In the tests, ground one side of the signal generator and/or audio oscillator to the receiver chassis as indicated in figure 6–1 and connect the other side to the receiver test point indicated in the procedure.

b. Receiver Preparation. To set up the receiver for signal substitution testing, use the setup described in paragraph 6-7. In addition, use card extender as required when rf amplifier units are being tested. To gain access to other plug-in units or to remove units to allow signal substitution procedures to be followed, use applicable procedure as follows:

(1) RF Tuner Plug-in Cards, Units A1, A2, A3 and A4. To remove card from rf tuner assembly, remove cover plate from rf tuner assembly and lift out card. Use card extender as required to make measurements, insert signals, etc (fig 1-2).

NOTE

Local oscillator unit A4 may not oscillate properly particularly on the higher frequency bands when on the extender card. This is normal because of the change in capacitance caused by the extender card and does not indicate a malfunction.

(2) Filters FL1 and FL2. The two mechanical filters in the if. signal path are located on the bottom of the chassis (fig 1-3) and secured by a common clamping bar. To remove either FL1 or FL2, remove screw securing clamping bar, remove bar and pull filter directly up from socket to gain access to socket terminals.

(3) Calibration Oscillator Unit A7. The calibration oscillator plug-in module is located on the underside of the chassis (fig 1-3). To reach components on the card for signal monitoring, remove the two screws holding the can in place and slide the can off module. If it is necessary to remove the module from the chassis, the can must be removed as above to gain access to the two quarter-turn fasteners holding the module to the chassis. Release the quarter-turn fasteners and pull module straight out from chassis.

(4) Other Plug-in Modules. The remaining plug-in modules which include the if. and audio units and the BFO, plug into the chassis. Access to the socket connections for each module can be obtained through the underside of the chassis (fig 1-3) or by removing the module in question from its socket.

c. Audio Frequency Tests. These tests start at the output of the audio output stage and work back towards the detector. At any point where a trouble is definitely identified and localized, stop the test procedure until the defective item is replaced or repaired and then resume if found necessary as a result of other troubleshooting work.

(1) Set audio oscillator for a frequency output of 1 kHz.

(2) Plug 600-ohm headset into AUDIO receptacle on front panel of receiver.

(3) Place receiver on by setting POWER switch to either VEH or BAT position depending upon power connections.

(4) Remove audio frequency amplifier unit A9 from socket.

(5) Turn audio oscillator output level to zero, apply signal from audio oscillator to pin E socket XA9 and slowly bring output level to maximum of 10 millivolts. If no signal is heard in headset, defect is in audio output stage consisting of Q1 and associated components, or in cabling to AUDIO receptacle J3 or in receptacle J3. If signal is heard, remove oscillator input and replace unit A9 in XA9.

(6) Apply signal from audio oscillator to pin E of XA9. If no signal is then heard, remove unit A9 from socket. If signal is then heard, unit A9 has an internal short.

(7) With unit A9 in socket, apply audio oscillator signal to pin B of XA9. If no signal is heard, unit A9 is defective. Check tubes and perform voltage and resistance check.

(8) Apply audio oscillator signal at 10 millivolts to pin 5 of XA6. Set AF GAIN control to maximum (extreme clockwise position). If no signal is heard, remove unit A6 from socket. If signal is then heard, unit A6 is shorted. If signal is still not heard, check potentiometer R2 and internal wiring.

d. IF. Tests. These tests start at the output of the detector and work back towards the output of the mixer. At any point where a trouble is identified and localized, stop the test procedure until the defective item is replaced or repaired and then resume if found to be necessary as a result of other troubleshooting work.

NOTE

The receiver is still to be on for this set of tests.

(1) Set RF signal generator to 455 kHz output with 1 kHz, 30% amplitude modulation, at 10 millivolts maximum level.

(2) Connect headset to AUDIO receptacle on front panel.

(3) Set AF GAIN control to maximum clockwise position.

(4) Set RF GAIN control to highest clockwise position before AGC marking.

(5) Set FUNCTION switch to AM position.

(6) Apply signal from signal generator to pin 1 of XA6. If tone is not heard in headset, adjust output level of signal generator. If tone is still not heard, if. output unit A6 is defective. Replace unit A6.

(7) Reset output level of signal generator to 10 millivolts maximum and apply signal to pin D of XA5. Signal level heard in headset should increase. If signal level does not increase, if. amplifier unit A5 is defective. If no signal is heard, unit A5 is defective. Check tubes and perform voltage and resistance check on module.

(8) Apply signal to pin 1 of filter FL1 and reset BANDWIDTH switch to 1.5 KC position. Signal should decrease slightly from level noted in step (7) above. If signal does not decrease or is not present, replace filter FL1.

(9) Apply signal to pin 1 of FL2 and reset BANDWIDTH switch to 4 KC position. Signal should decrease slightly. If signal does not decrease or is not present, replace filter FL2.

e. RF Tests. These tests use the same equipment as in *d* above with the receiver controls and switches set as in steps (2) through (5) of *d*. Then proceed as follows:

(1) Set signal generator to some frequency, amplitude-modulated, within the range of the receiver.

(2) Tune receiver using tuning control and BAND switch to the signal generator output frequency.

(3) Set signal generator for nominal output of 10 millivolts.

(4) Apply signal from signal generator to stator terminal of tuning capacitor section C2C. Adjust signal generator output trying to obtain tone in headset. If tone can not be heard with maximum output of signal generator at 70 millivolts, check or replace mixer unit A3 or oscillator unit A4. If signal still can not be heard, check wiring and connector A11J3.

(5) Apply signal to stator terminal of tuning capacitor section C2B. If no tone is heard, replace second rf amplifier unit A2.

(6) Apply signal to stator terminal of tuning capacitor section C2A. If no tone is heard, replace first rf amplifier unit A1.

(7) Apply signal to 50 OHM antenna input receptacle and set ANT switch to corresponding position. If no tone is heard, check ANT switch S1, receptacle J2 and wiring.

6–10. Stage-Gain Measurements

The stage-gain measurements procedure is used when the receiver output is distorted or abnormally low and the trouble can not be corrected by module or tube replacement. Stage-gain measurements should be used for trouble localizing only after trying a full receiver alignment as described in paragraph 6–20. Trouble localized to a particular stage may be isolated within a particular stage by the techniques given in paragraph 6–11. Prepare the receiver in accordance with the instructions of paragraph 6–7, In addition, do the following:

a. Set AF GAIN control to position giving 10 milliwatts output for 1 microvolt input of signal source (step *e* below).

b. Set RF GAIN control to highest clockwise position before AGC.

c. Connect 600-ohm, ½-watt resistor and a VTVM between AUDIO connector and ground as shown in figure 6–1.

d. Set other front panel controls and switches as follows:

FUNCTION switch	—	AM
BANDWIDTH switch	—	4 KC
BAND switch	—	5, 15 Mc
ANT TRIM	—	Set for peak output
BFO PITCH	—	0
ANT switch	—	50 OHM

e. Connect proper signal source between designated test point and ground as indicated in table 6–3, resetting AF GAIN control when so indicated in chart.

NOTE

If calculated gain is within range of 25 to 50% of indicated value, stage is considered to be operating properly.

Table 6–3. Stage-Gain Chart

Test Conn.	*Input Signal*	*Input (Microvolts)*	*Audio Output (Volts)*
Arm of AF GAIN control R2	1 kHz	11000	2.45
Pin 1–XA6 assembly	455 kHz at 30% mod of 1 kHz	7600	2.45
Pin D–XA5 assembly	455 kHz at 30% mod of 1 kHz	325	2.45
Across section C2C	455 kHz at 30% mod of 1 kHz	550	2.45
Across section C2B	1.5 mHz at 30% mod of 1 kHz	125	2.45
Across section C2A	1.5 mHz at 30% mod of 1 kHz	5.0	2.45
Across 20 db 50 ohm attenuator	1.5 mHz at 30% mod of 1 kHz	1.0	2.45

6–11. Isolating Troubles Within The Stage

When the trouble has been localized to a stage either through operational checks or signal substitution (para 6–9), use the following

techniques to isolate the defective module or part:

a. Test the tube involved or substitute a known good tube.

b. Take voltage measurements at the tube or plug-in module connector and at other points related to the questionable stage (para 6–4).

c. If voltage readings are inconclusive or abnormal, take resistance readings (para 6–4) to isolate open and short circuits.

d. If signals are weak and all other checks do not indicate a defective part, recheck the alignment of the receiver using the procedure of paragraph 6–20.

e. Use the schematic diagram of the receiver (fig 5–2) to circuit trace and analyze the source of the difficulty.

Section III. REPLACEMENTS AND CIRCUIT ALIGNMENT

6–12. General Replacement Techniques

Radio Receiver R–901/GR has been designed so that all critical circuits are contained on easily replaced plug-in units. Within some of these plug-in units, the vacuum tubes are easily replaced. Direct support maintenance is normally limited to the replacement of the plug-in modules and the vacuum tubes which are easily replaced without special tools or technical ability in addition to those replacement described in the areas of operator and organizational maintenance. Paragraph 6–13 through 6–19 contain instructions for module replacement and tube replacement within the modules. The following general precautions apply to parts replacement in this receiver:

a. When replacing subminiature-type vacuum tubes on plug-in modules, note position of leads on tubes already installed before removing. Also note positions of color dot marking on tube, card, or module. Keep tube leads as short as possible within the limits given for a particular card or module. Insure lead engage socket securely.

b. Use minimum heat, preferably a pencil-type soldering iron of 25-watt maximum rating. If only ac-operated irons are available, use an isolating transformer. Do not use a soldering gun; damaging voltages may be induced in the components.

c. In all soldering operations, solder quickly. If physical room permits, use a heat sink such as a long-nosed pliers, electrical test clips, or other metallic heat conducting devices.

d. Where insulated tubing has been used on tube leads, always reuse the tubing or provide equivalent tubing on replacement tubes.

6–13. RF Tuner Assembly Modules Replacement

The four plug-in modules mounted on the rf tuner assembly (fig 1–2) include the first rf amplifier unit A1, second rf amplifier unit A2, mixer unit A3 and local oscillator unit A4. Each card contains one subminiature-type vacuum tube and associated components (fig 6–2 through 6–5).

a. Removal and Replacement of Modules. Access to all of the four modules can be done by loosening of the fasteners holding the rf shield in place on the top of the rf tuner assembly and lifting off the shield. The individual card can be removed by inserting a screwdriver blade into the slot on either side of the card and pushing down gently on the handle of the screwdriver so that the blade forces the card upward out of its receptacle. If desired, a hook may be used. Insert hook in hole in case and pull straight up. To reinsert the card, mate the card with its corresponding slot and press down firmly until card is seated in its receptacle. The card connectors are mechanically keyed to prevent reversal in the compartment.

b. Replacement of Vacuum Tube. To replace a vacuum tube on a card, unsolder the leads coming through the printed circuit board on the rear of the card and pull tube from spring clip. When inserting new tube, check that the red dot on the tube is on left side as seen from the front of the card. Use insulated tubing on leads as shown in applicable card illustration.

6–14. Replacement of IF Amplifier

The if amplifier unit A5 is mounted on the top of the chassis (see figure 1–2). The module consists of a printed circuit card, figure 6–6, on the front of which is mounted the connector P1, and a rear plate, figure 6–7, on which are mounted two transformers T1 and T2 and the two vacuum tubes V1 and V2.

a. Replacement of Modules. To unplug the if. amplifier, remove the two screws in the bar holding the module in place on the chassis and pull straight up and out of the receptacle. Pull only on the bar to remove the module from the chassis. To replace module, insert it between the guide bars and push downward so that P1 on

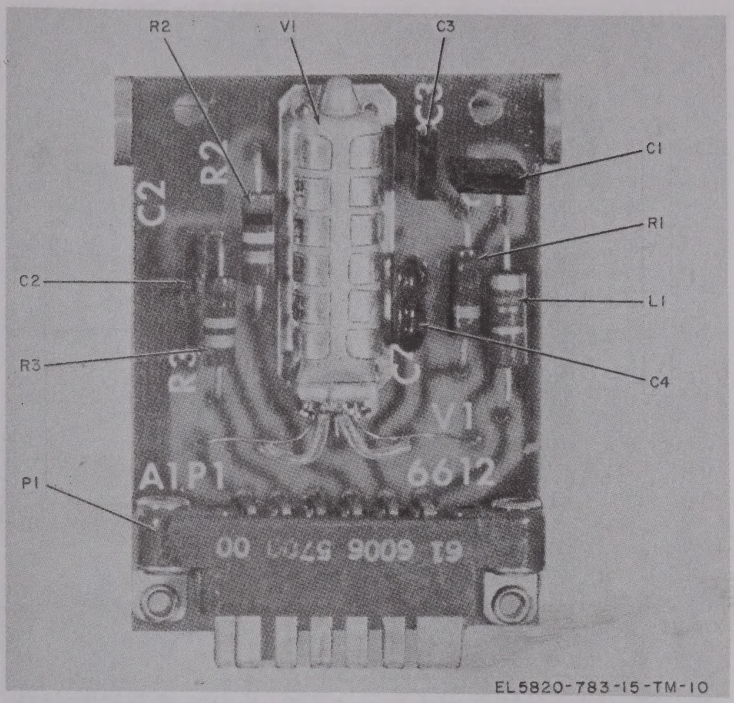

Figure 6–2. First RF Amplifier Unit A1.

the module mates firmly with receptacle on the chassis. Replace securing screws in the top of the bar across the top of the module.

b. Replacement of Tubes. Remove the two screws in the printed circuit card holding the holddown bar in place across the tops of the two vacuum tubes and transformers. Lift the bar and the cushioning material off from the tops of the tubes and transformers. Remove either tube by pulling straight upward out of socket in the base bracket. When inserting new tube, precut leads to 732″ and insert tube with red dot on the tube aligned with red dot on tube socket. Remove cushioning material and holddown bar and secure with screws through printed circuit board.

6–15. Replacement of Audio Frequency Amplifier

The audio frequency amplifier unit A9 is secured to the chassis in a manner similar to that of the if amplifier (fig 1–2). The af amplifier contains two subminiature-type vacuum tubes, V1 and V2, on a printed circuit card along with associated components. The card, figure 6–8, also has mounted to it a connector that mates with the receptacle on the chassis.

a. Replacement of Module. To remove the module from the receiver, remove the two screws in the top bar holding the card in place. Lift directly upward on the bar until connector P1 is free of the receptacle on the chassis. To replace module, insert card between guides with connector aligned to mate with receptacle and secure with two screws through clamping across top of module.

b. Tube Replacement. To replace either vacuum tube, unsolder tube leads from printed circuit card where leads come through to rear of card. Pry tube gently from retaining clip and remove from card. When replacing tubes, align tube with red dot matching corresponding dot on card as seen from front of card and push gently but firmly into holding clip. Replace insulated tubing on tube leads before soldering in place on rear of card.

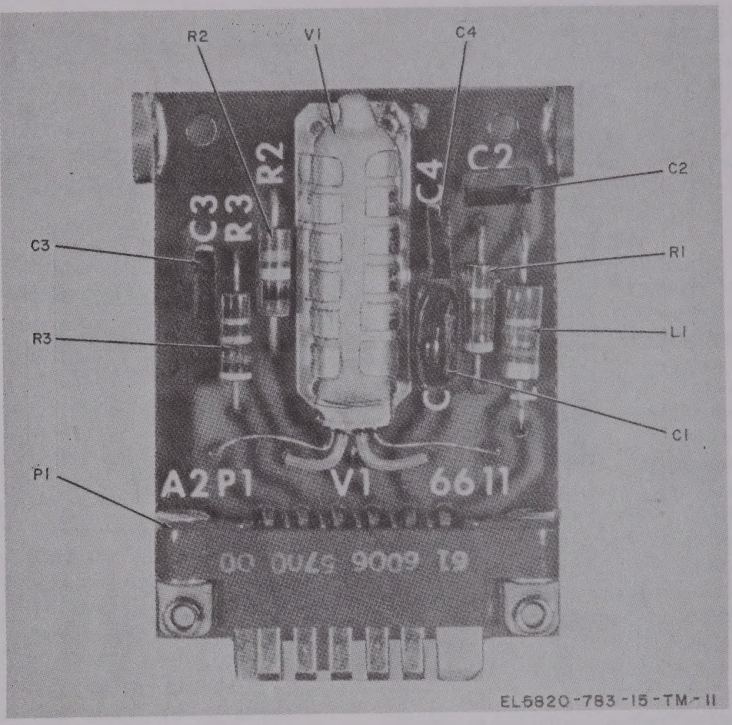

Figure 6–3. Second RF Amplifier Unit A2.

6–16. Replacement of Beat Frequency Oscillator

The beat frequency oscillator unit A8 is a shielded module plugged into a receptacle on the chassis (fig 1–2). The module contain one subminiature-type vacuum tube mounted on one side of a printed circuit card. Other components are mounted on the front of the card and on the rear, figures 6–9 and 6–10. The card is mounted on a base that includes the module plug. A shield fits over the card and into the base.

a. Removal of Module. The module is secured to the chassis by two screws through flanges on the base. To remove the module, remove the screws through the flanges into the chassis and lift module straight up from the socket on chassis. To remove the shield, remove screws at the top of shield in treaded bracket on card and lift shield straight up from the base and clear of the card. When replacing shield, line the shield up with the tabs on the base and slide home, securing with screw through top of shield. Replace the module on chassis by lining up socket key and seating module firmly. Secure with screws through flanges into chassis.

b. Removal of Tube. To remove the tube, pry gently from tube clip anb pull straight outward from card until the tube leads are free of the socket. To install new tube, cut leads to 11/32" and bend at right angles keeping dot on the tube aligned with the dot on the socket. Insert the tube leads into the socket and press the tube firmly into the clip on the card.

6–17. Replacement of IF Output

The if output unit A6 is mounted on the chassis (see figure 1–2). It is similar in construction to the beat frequency oscillator and the instructions for the bfo (para 6–16) apply to the if output module (fig 6–11 and 6–12).

6–18. Replacement of Calibration Oscillator

The calibration oscillator unit A7 is mounted on the underside of the chassis (fig 1–3). The module consists of a printed circuit card on a base

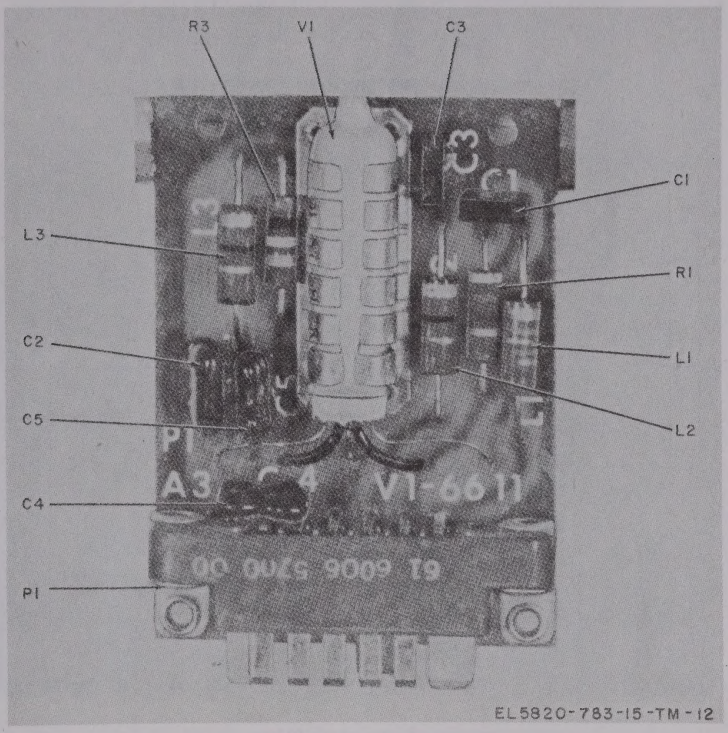

Figure 6-4. Mixer Unit A3.

that is secured in its receptacle by two quarter-turn fasteners. The entire module is inclosed in a shield secured to the base by screws through the top of the shield can. The module contains one replaceable subminiature-type vacuum tube and two replaceable crystals, (fig 6-13 and 6-14).

a. Removal of Module. To remove module from the chassis, loosen and remove the screws in the opposite corners of the shield. Pull shield directly outward from the module base. Using a long screwdriver, insert blade into the two quarter-turn fasteners at opposite corners of the base and press and turn to the left to release. Lift module straight upward from the slot. Replace by seating module in compartment and seat connector firmly into the receptacle. Secure with quarter-turn push and turn fasteners and replace shield can in place. Secure shield with screws to floating nuts at top of printed circuit card. Tighten screws.

b. Removal of Tube and Filters. To replace tube, use techniques described in paragraph 6-16*a*. To replace either Y1 or Y2, pull crystal directly upward out of socket and clip. Insert new crystal by placing filter prongs into the socket and pushing firmly downward until the crystal is firmly seated in the socket and the retaining clip.

6-19. Alignment Procedure Usage

The overall alignment procedures should be used primarily for aligning the receiver after the replacement of any plug-in module or tube. It may also be used as part of the troubleshooting procedures when the receiver does not perform properly and no specific trouble or defect can be localized.

6-20. Alignment Procedure

The overall alignment procedure is divided into two portions, if. alignment and rf alignment. The basic receiver preparation and test equipment connections are the same for both align-

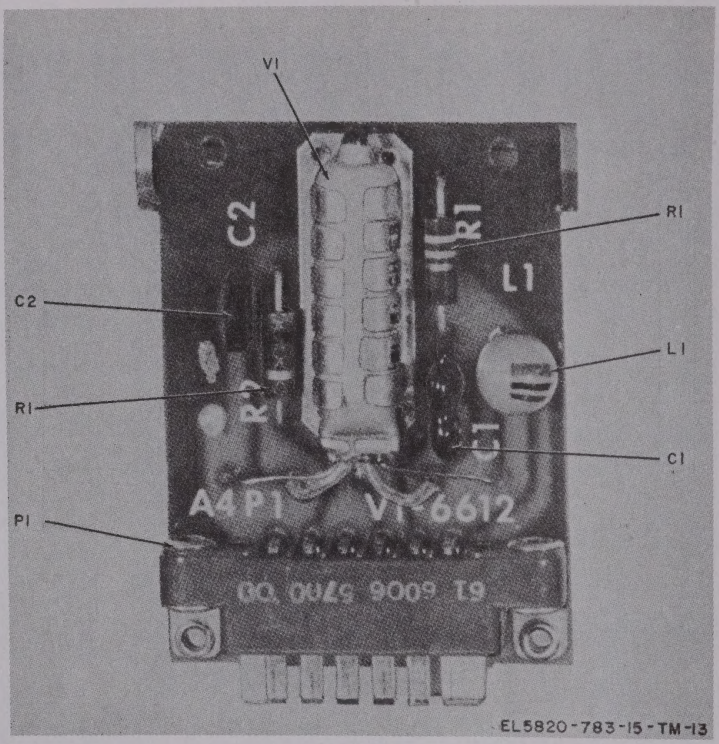

Figure 6–5. Local Oscillator.

ments except as noted in the detailed procedures.

a. Receiver Preparation. The power connections and receiver preparation are the same as those given paragraphs 6–4 and 6–7, including figure 6–1. The test equipment required for the alignment procedures is listed in paragraph 6–3 and requires, in addition;

(1) Headset H–113U and cord CD–307A or equivalent.

(2) Adaptors (attenuator) if necessary.

b. IF Alignment.

(1) Set front panel POWER switch to either VEH or BAT position as applicable and allow receiver to warm up for minimum period of 10 minutes.

(2) While receiver is warming up, calibrate rf signal generator at 500 kHz output frequency.

(3) Disconnect P3 from receptacle J3 on rf tuner assembly.

(4) Connect VTVM to AUDIO output receptacle on front panel across 600-ohm resistor as shown in figure 6–1.

(5) Connect rf signal generator to P3 through 20 db attenuator.

(6) Reset rf signal generator to 455 kHz with amplitude modulation of 30% at 1 kHz.

(7) Set front panel controls of receiver to:

RF GAIN	—	maximum cw position before AGC ON
AF GAIN	—	maximum cw position
FUNCTION	—	AM position
BANDWIDTH	—	4 KC position

(8) Adjust rf signal generator output to provide 2.5 volts receiver output as read on VTVM.

(9) Align if. transformers A5T1 and A5T2 (on if. amplifier unit A5) for maximum output, reducing rf signal generator output as necessary to prevent audio output exceeding 2.5 volts.

NOTE

If. transformers A5T1 and A5T2 have top and bottom slug adjustments. Top slug adjustments can be made without removing the module from the socket. Bottom slug adjustments may be made

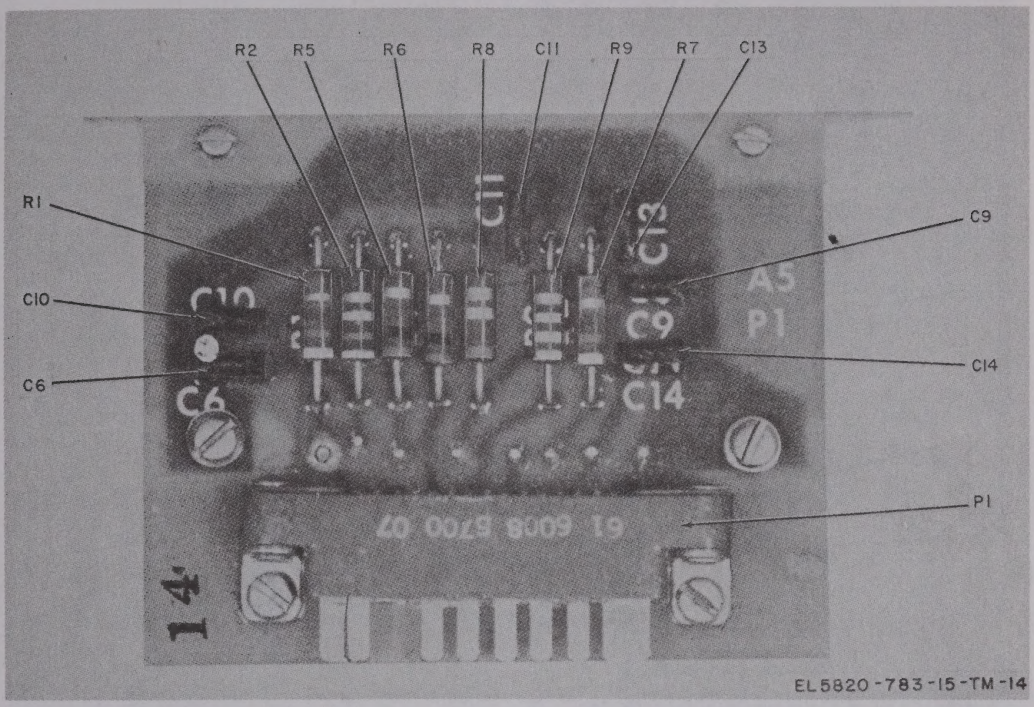

Figure 6-6. Front View, IF Amplifier Unit A5.

through the cutout in the chassis by moving the wiring harness slightly.

(10) Align inductor A6L1 (on if. output unit A6) for maximum output, reducing rf signal generator output as required to maintain 2.5-volts maximum as read on VTVM.

(11) Adjust trimmer capacitors C7 and C13 on the chassis (associated with filter FL2) for maximum output.

(12) Set BANDWIDTH selector on the front panel to 1.5 KC position.

(13) Adjust trimmer capacitors C5 and C11 on the chassis (associated with filter FL1) for maximum output. Reset BANDWIDTH switch to 4 KC position.

(14) Disconnect VTVM and resistor and plug headset into AUDIO output receptacle on front panel.

(15) Reduce rf signal generator output to level providing comfortable listing level in headset.

(16) Set FUNCTION switch to CW position and remove modulation.

(17) Set BFO PITCH control to position providing zero beat as heard in the headset and check that the control is at 0 position or midpoint position. Reset control knob if required.

(18) Disconnect headset and rf signal generator from the receiver.

(19) Set power switch to the OFF position.

(20) Reconnect P3 and J3 on rf tuner assembly.

c. RF Alignment.

(1) Connect rf signal generator to 50 OHM input receptacle as shown in figure 6-1.

(2) Connect a VTVM to the output connector as shown in figure 6-1.

(3) Set POWER switch on the receiver panel to VEH or BAT position depending upon available power source.

(4) Set receiver front panel controls and switches as follows:

RF GAIN	—	maximum cw position before AGC ON position
AF GAIN	—	maximum cw position
FUNCTION	—	AM position
ANT switch	—	50 OHM position

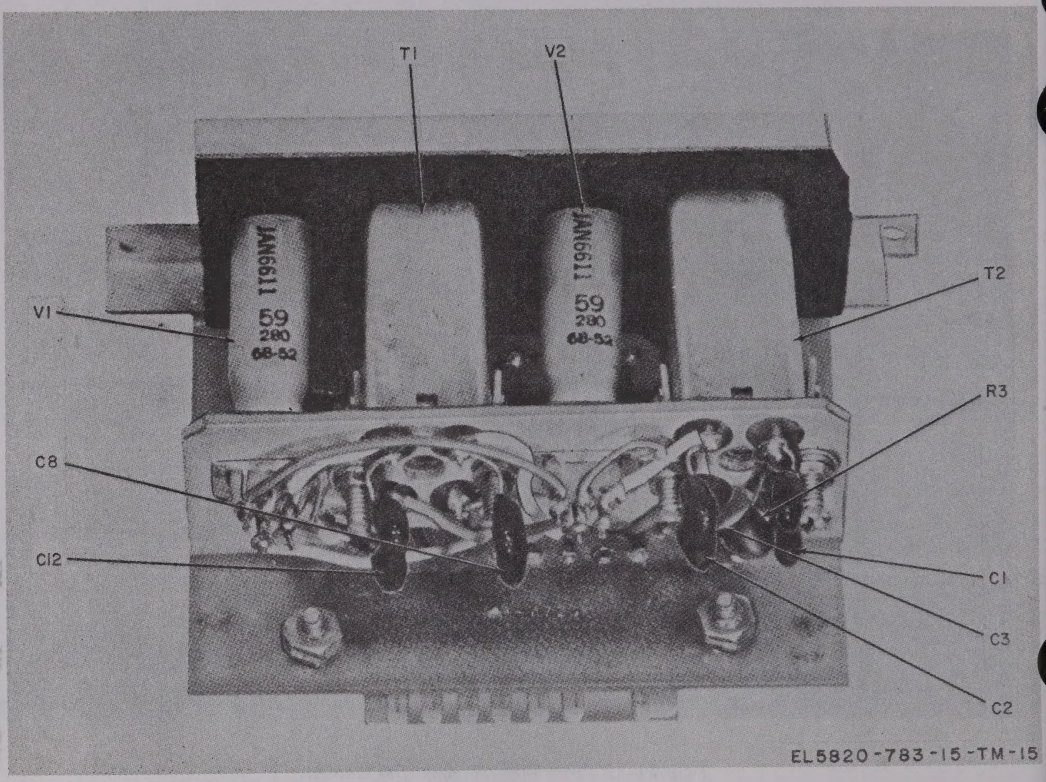

Figure 6-7. 3/4 Rear View, IF Amplifier Unit A5.

BANDWIDTH	—	4 KC
ANT TRIM	—	midposition
CAL ADJ	—	Pointer bar in midposition of travel

(5) Perform steps of table 6-4 for rf signal generator frequency setting and alignments. For each rf signal generator setting, calibrate the signal generator to nearest 100 kHz before tuning receiver to same frequency. Set rf signal generator for 30% modulation at 1 kHz with maximum setting of 2.5 volts rms on the VTVM, resetting the output of the signal generator as necessary.

Table 6-4. RF Alignment Step

Step	RF Sig. Gen. Freq. (mHz)	Receiver Tuning (mHz)	Adjust for Peak Output	Circuit	Remarks
1	0.536	0.536	L16	Local osc.	Set BANDSWITCH at 1
2	1.154	1.154	C26	"	"
3	Repeat steps 1 and 2 as many times as required to peak output				
4	0.550	0.550	L1, L6, L11	Ant, 1st rf, 2nd rf	BANDSWITCH at 1
5	1.100	1.100	C10, C15, C20	"	"
6	Repeat steps and 5 as many times as required to peak output				

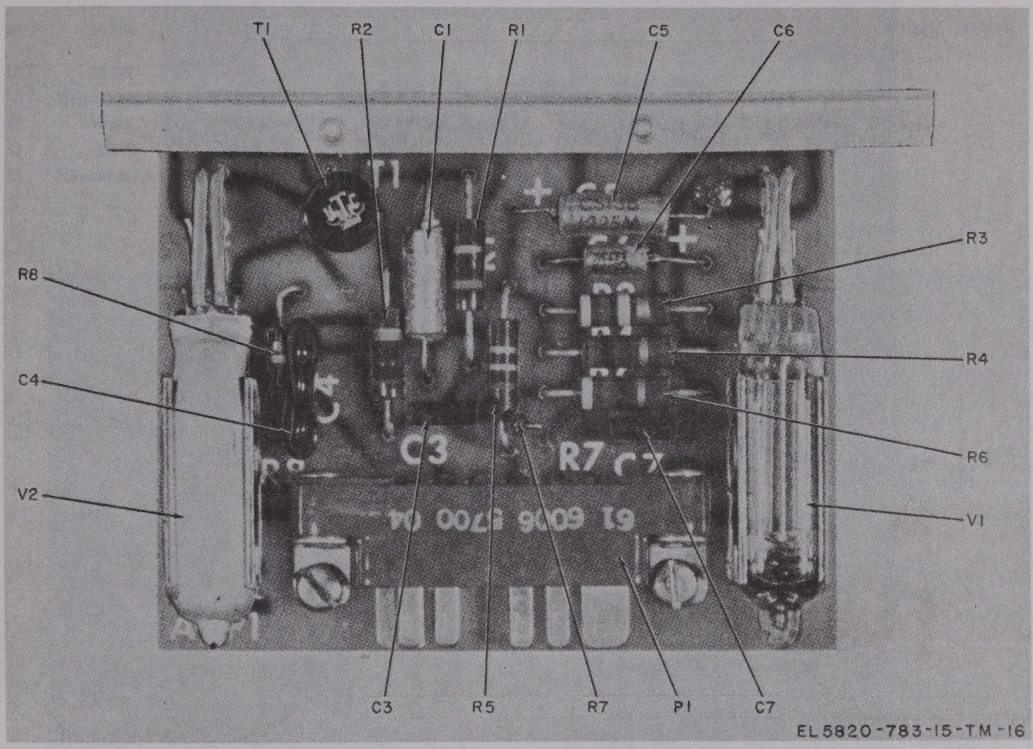

Figure 6-8. Audio Amplifier Unit A9.

Step	RF Sig. Gen Freq. (mHz)	Receiver Tuning (mHz)	Adjust for Peak Output	Circuit	Remarks
7	1.098	1.098	L17	Local osc.	BANDSWITCH at 2
8	2.368	2.368	C27	"	"
9	Repeat steps 7 and 8 as many times as required to peak output				
10	1.150	1.150	L2, L7, L12	Ant, 1st rf, 2nd rf	BANDSWITCH at 2
11	2.300	2.300	C11, C16, C21	"	"
12	Repeat steps 10 and 11 as many times as required to peak output				
13	2.252	2.252	L18	Local osc.	BANDSWITCH at 3
14	4.848	4.848	C28	"	"
15	Repeat steps 13 and 14 as many times as required to peak output				
16	2.350	2.350	L3, L8, L13	Ant, 1st rf, 2nd rf	BANDSWITCH at 3
17	4.700	4.700	C12, C17, C22	"	"

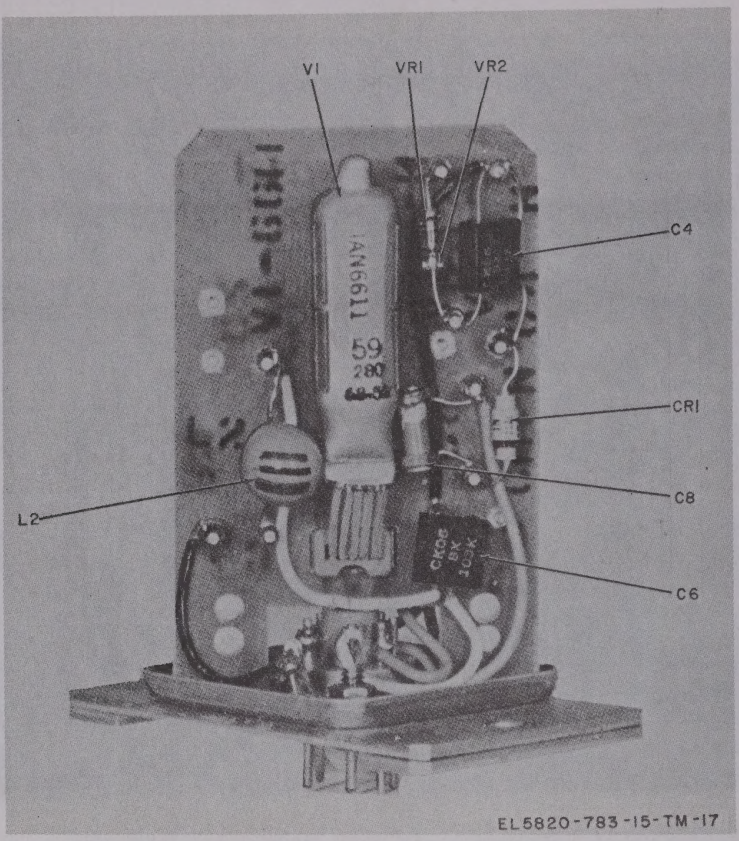

Figure 6-9. Beat Frequency Oscillator Unit A8, Tube Side.

Step	RF Sig. Gen Freq. (mHz)	Receiver Tuning (mHz)	Adjust for Peak Output	Circuit	Remarks
18	Repeat steps 16 and 17 as many times as required to peak output				
19	4.612	4.612	L19	Local osc.	BANDSWITCH at 4
20	9.942	9.942	C29	"	"
21	Repeat steps 19 and 20 as many times as required to peak output				
22	4.800	4.800	L4, L9, L14	Ant, 1st rf, 2nd rf	BANDSWITCH at 4
23	9.600	9.600	C13, C18, C23	"	"
24	Repeat steps 22 and 23 as many times as required to peak output				
25	9.458	9.458	L20	Local osc.	BANDSWITCH at 5
26	20.050	20.050	C30	"	"
27	Repeat steps 25 and 26 as many times as required to peak output				

Step	RF Sig. Gen Freq. (mHz)	Receiver Tuning (mHz)	Adjust for Peak Output	Circuit	Remarks
28	10.368	9.458	.....	.....	Image freq. Check, BAND-SWITCH at 5
29	20.960	20.050			"
30	Repeat steps 25 and 26 if steps 28 and 29 indicate tuned to wrong frequency				
31	10.000	10.000	L5, L10, L15	Ant, 1st rf, 2nd rf	BANDSWITCH at 5
32	20.000	20.000	C14, C19, C24	"	"
33	Repeat steps 31 and 32 as many times as required to peak output				

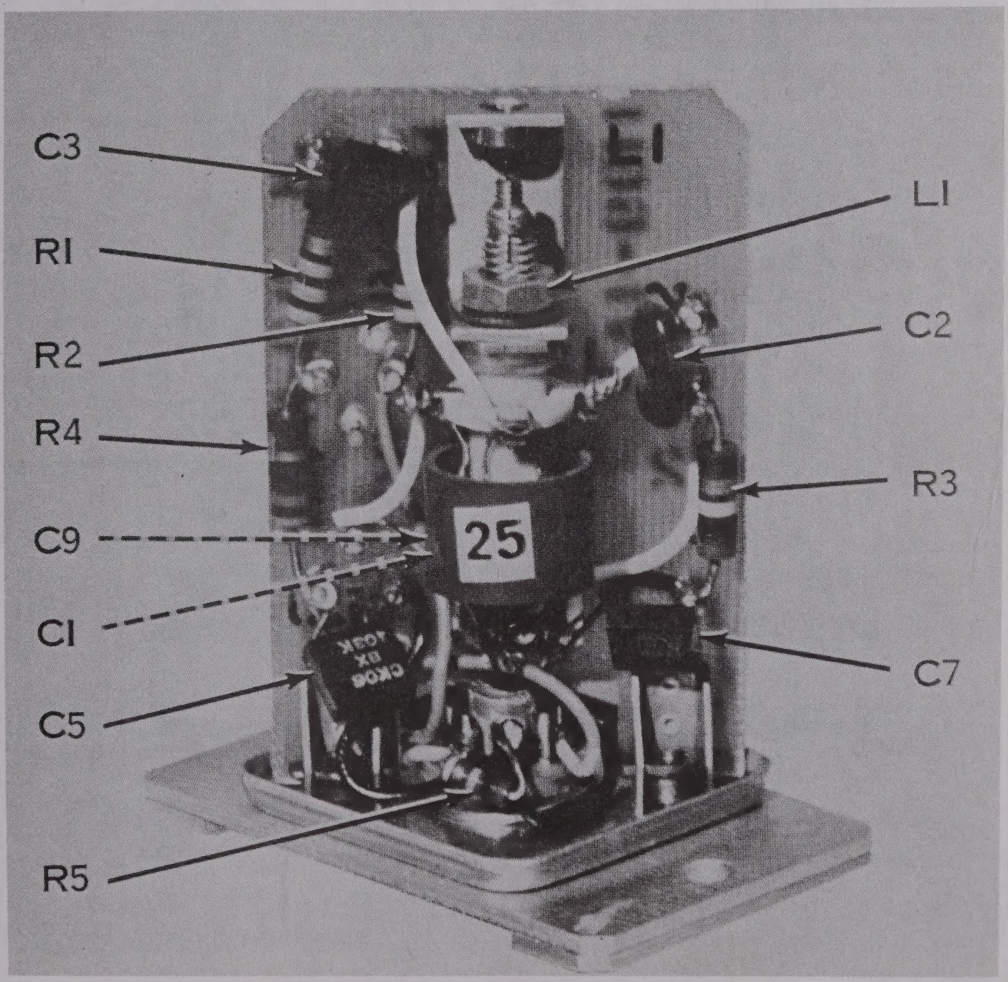

Figure 6-10. Modified Beat Frequency Oscillator Unit A8, reverse side.

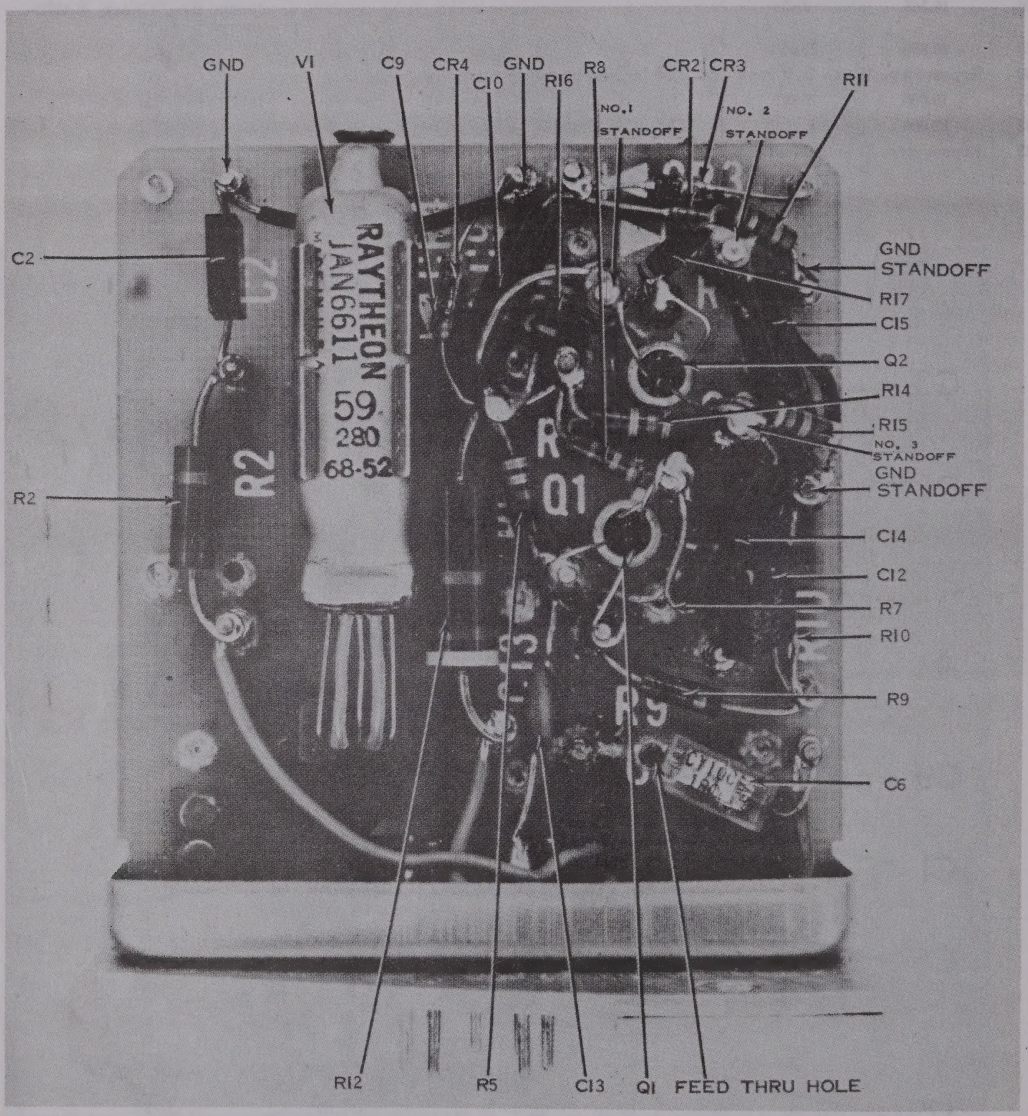

Figure 6-11. Modified IF Output Unit A6, tube side.

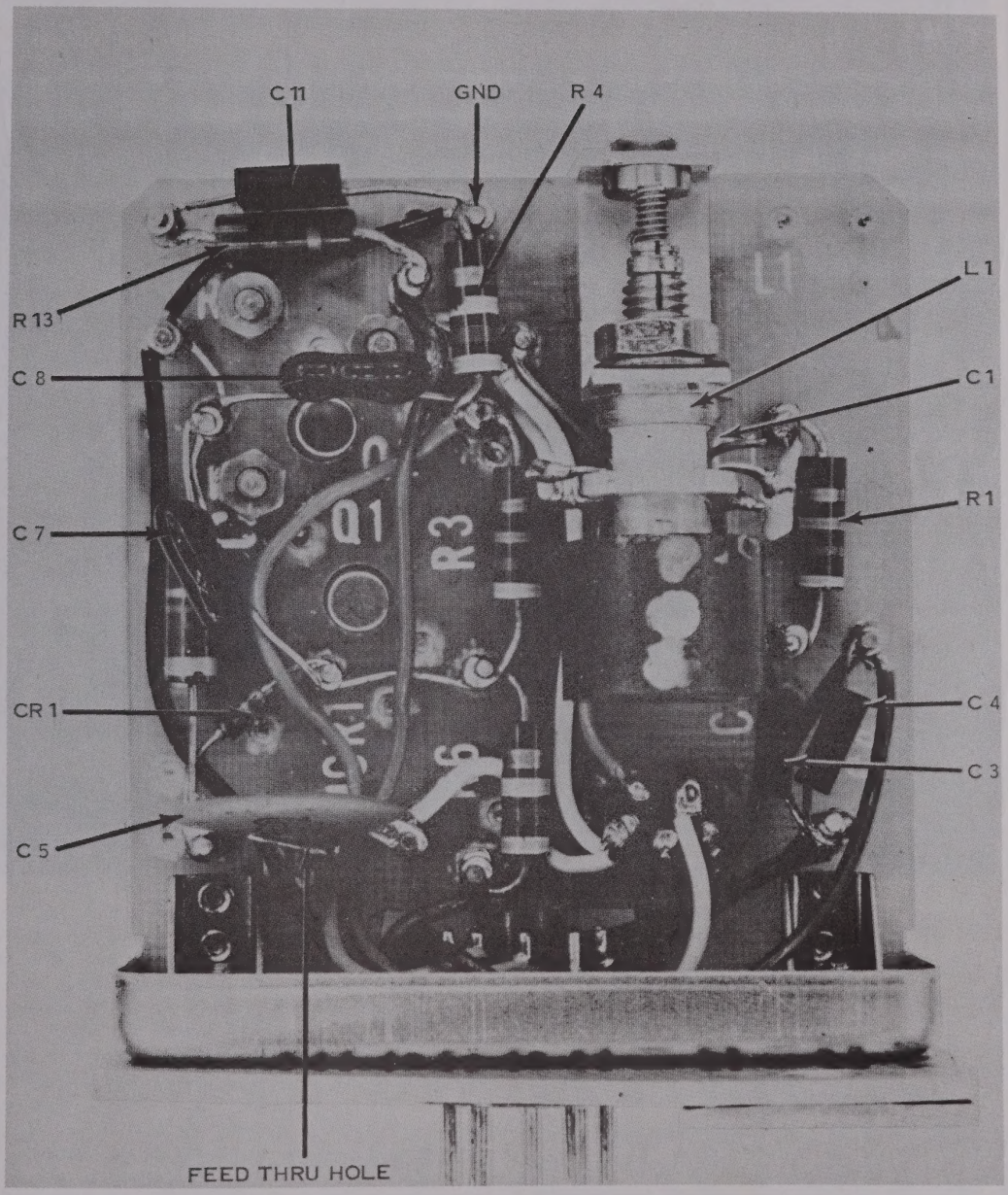

Figure 6-12. Modified IF Output Unit A6, coil side.

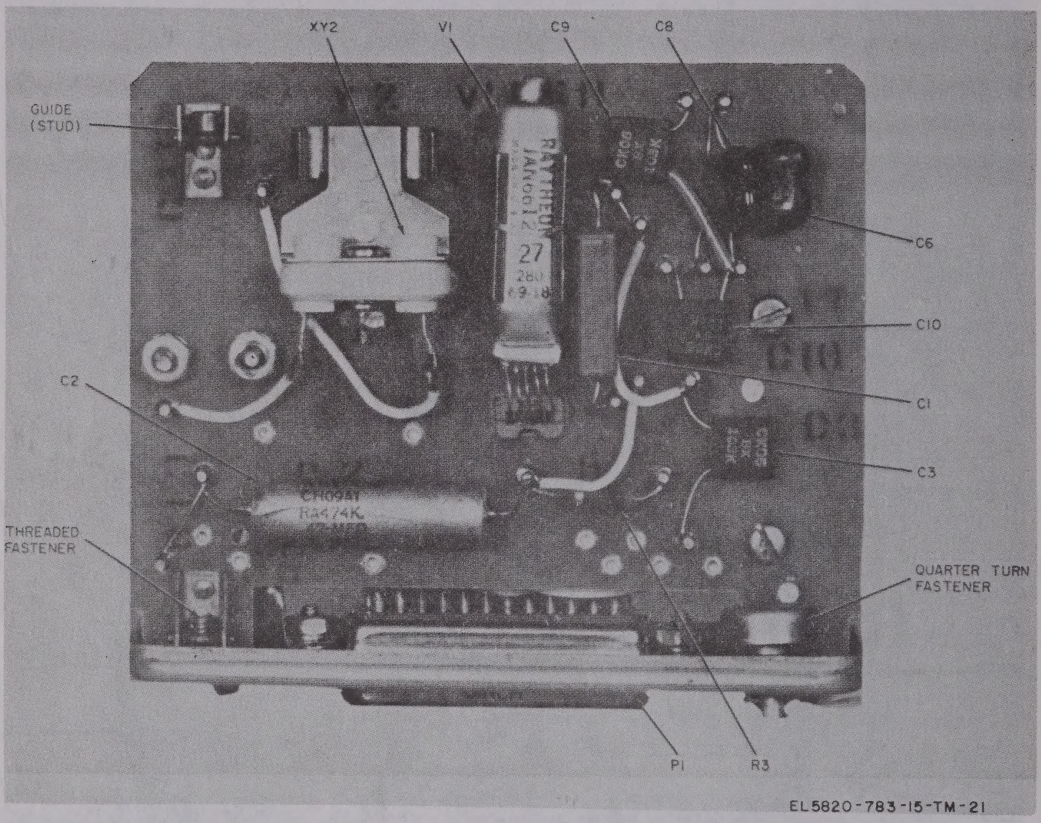

Figure 6-13. Calibration Oscillator Unit A7, tube side.

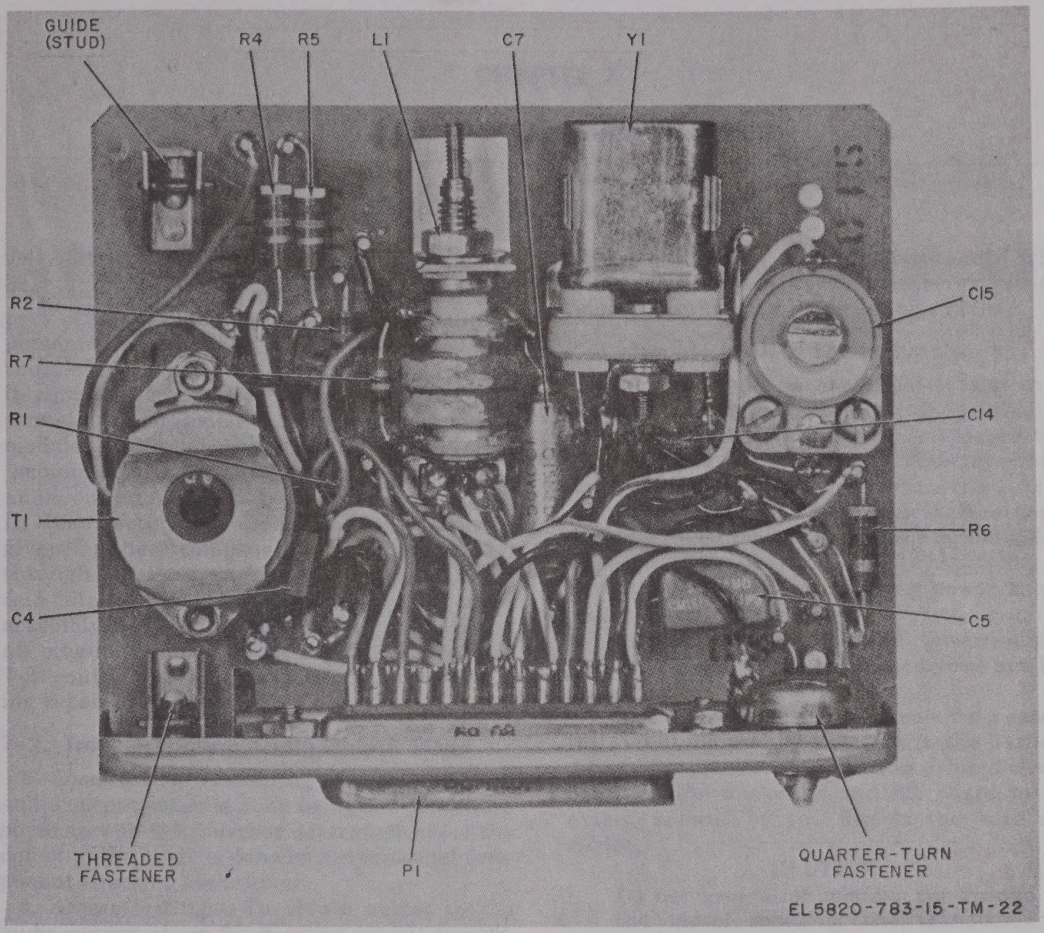

Figure 6-14. Calibration Oscillator Unit A7, Reverse Side.

CHAPTER 7

GENERAL SUPPORT MAINTENANCE

SECTION I. TROUBLESHOOTING

7-1. General Maintenance Information

The maintenance procedures for general support personnel include those of direct support personnel as described in chapter 6 as well as those of lower category personnel as described in chapter 4. In addition, general support personnel are responsible for repairs of all plug-in modules and other components of the receiver including particularly the rf tuner assembly, audio output stage, and internal power supply. In this chapter, troubleshooting information is given for these components in paragraphs 7-2 through 7-5. Paragraphs 7-6 through 7-13 contain detailed repair information for the rf tuner assembly, audio output stage, power supply and all plug-in modules. Paragraphs 7-14 through 7-24 contain detailed test procedures for checking repaired modules.

7-2. Troubleshooting Audio Output Stage

a. Localization. Localizing of a defect to the audio output stage is done using the procedure of paragraph 6-9. Further determination of the defect in the stage is done by conventional component checking techniques.

b. Access to Stage. To obtain access to the audio output stage for detailed circuit tracing and component checking, remove the audio frequency amplifier unit A9 (fig 1-2). If further room is needed to get to the printed circuit board containing transistor Q1 and associated components, remove the right side bracket (as seen from the rear) of the audio frequency amplifier unit A9 from the chassis. If necessary, also remove if. output unit A6 module from the chassis.

CAUTION

Do not use ohmmeter with output in excess of 1.5-volts at test probes when checking transistor to avoid possible burnout.

c. Component Checking. Use schematic diagram figure 5-2 for circuit tracing and component checking of audio output stage. Remove components from printed circuit only when ohmmeter checks provide vague or indeterminate results or indicate definite faults.

7-3. Troubleshooting Power Supply

The power supply is contained in the cover assembly unit A10. It consists of a printed circuit board mounted within an enclosure that also contains a number of individual components on the walls of the enclosure (fig 1-3).

a. Removal of the Power Supply. The power supply may be removed as a unit by the following procedure:

(1) Remove screws securing power supply enclosure within the case.

(2) Remove cover of the power supply enclosure by removing securing screws and lifting off cover.

(3) Lift power supply enclosure from case to the extent allowed by the slack in the harness.

(4) Remove screws securing printed circuit board to the enclosure and lift board to the extent allowed by the flex in the wire and cables.

CAUTION

Do not ground or mistake for ground the metal cases of the transistors A10Q1, A10Q4 and A10Q5. These cases operate at potentials other than ground in the circuit.

b. Circuit and Component Checking. The overall power supply may be checked using the voltage and resistance measurements of table 6-1. Further localization to the individual defective component may be done by checking with an ohmmeter and continuity checker.

7-4. Troubleshooting the RF Tuner Assembly

The rf tuner unit A11 consists of the tuning capacitor C2, the bandswitch S1, and the associated capacitor and inductances including antenna trimmer capacitor C1. Troubleshooting of the tuner can be done using conventional circuit tracing and component checking techniques. The trimming capacitors and induc-

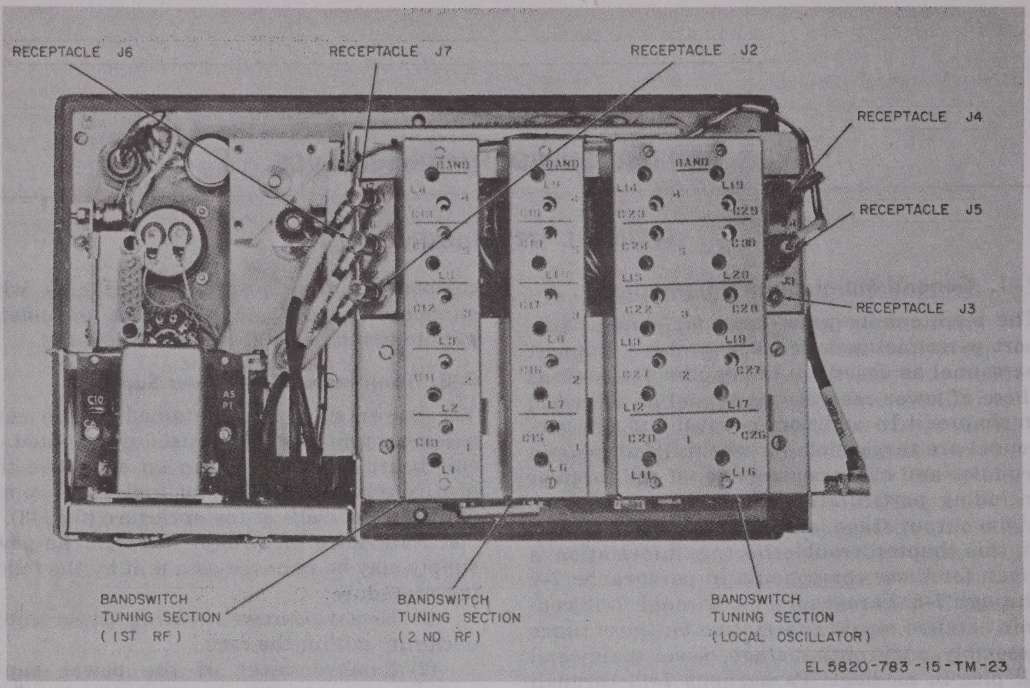

Figure 7–1. Radio Receiver R–901/GR, Rear view.

tances are mounted on circuit boards located at the rear of the tuner assembly (fig 7–1). To obtain access to these boards, remove the screws holding the shield covers in place and remove the covers. To remove a board from the tuner assembly, remove the screws and nuts holding the board in place in the assembly and lift the board out as far as the flex in the wires will allow.

7–5. Troubleshooting Other Components

Other components can be checked by continuity checking and circuit tracing. The resistors associated with the meter switch S4 (R5 through R9) and the resistors and capacitors (R10 through R13, C9, C15 and C16) are located on the circuit board on the underside of the chassis (fig 1–3). The components mounted on the front panel are accessible either from the area directly above the audio output stage or by removing the rf tuner assembly (para 7–12).

SECTION II. REPAIRS

7–6. General Repair Techniques

All assemblies of Radio Receiver R–901/GR can be repaired by replacement of individual components, repair of plug-in modules, etc. No special tools or technical ability are required to repair any of the receiver assemblies. The following precautions apply to parts replacement in the receiver:

a. When replacing transistors and associated parts, use a pencil-type soldering iron of 25-watt maximum rating. If only ac-operated irons are available, use an isolating transformer. Do not use a soldering gun; damaging voltages may be induced in components.

b. Avoid movements or disturbances of internal wiring configurations as much as possible to avoid undesired coupling effects.

c. In all soldering operations, solder quickly. Where physical space permits, always use a heat sink on transitor and semiconductor diode

leads. Heat-sinking can be provided by long-nosed pliers, alligator clips or other metallic devices.

d. Apply minimum heat to printed circuit boards when desoldering components. Always remove excess solder flux from boards after desoldering or soldering new parts in place. See paragraph 7–7 for recommended desoldering techniques.

7–7. Recommended Desoldering Procedure

Removal of parts from printed circuit boards requires desoldering with minimum damage to through holes, plated lands, and other current-conducting paths on the board. The following procedure is recommended to minimize damage to the printed circuit board:

a. Apply solder flux on rear of printed circuit board where component leads are soldered.

b. Place section of tinned braid approximately ¼-inch wide directly on portion to be desoldered.

c. With heated soldering iron tip, press braid down against point to be desoldered until solder can be seen entering braid. Under normal conditions, the printed circuit board can not be damaged by excessive heat because of the heat-sinking characteristic of the braid.

d. Lift iron tip and braid from board surface and inspect. If all solder has been removed and component lead can be moved, proceed to step *e* below. If solder still remains, shift to clean portion of braid and repeat steps *b* and *c* above.

e. Desolder other leads of same component using procedure of steps *b* through *d* above.

f. Remove component from printed circuit board.

g. Remove all excess solder flux from board using standard solvent.

7–8. Repair of RF Tuner Modules

Removal of the four plug-in modules of the rf tuner for repair is in accordance with the instructions given in paragraph 6–13. Repair of the individual card can be done by straight-forward component replacements or resoldering where required. A card showing breaks in the base material or in the printed circuit paths should not be repaired. After repair, test cards using procedure of paragraph 7–19.

7–9. Repair of IF Amplifier

Removal of the if. amplifier unit A5 is described in paragraph 6–14. Repair of the card can be done by straight-forward component replacement or resoldering where required. Do not repair card if breaks show in base material or in top retaining bar or bracket holding sockets and transformers. After repair, test module using procedure of paragraph 7–20.

7–10. Repair of Audio Frequency Amplifier

Removal of the audio frequency amplifier unit A9 is described in paragraph 6–15. Repair of the module can be done by component replacement or resoldering where required. Do not repair printed circuit card if breaks show in base material or printed circuit paths. After repair, test module using procedure of paragraph 7–23.

7–11. Repair of Variable BFO, Calibration Oscillator and IF Output Modules

Removal and disassembly for repair procedures for these modules are given in paragraphs 6–17 through 6–18. Replace shield can on each module before testing in accordance with procedure of paragraph 7–22.

7–12. Removal of RF Tuner Assembly

Repairs of the tuner assembly can normally be performed with the tuner in place on the chassis. If necessary for tuner repairs or to gain access to controls and switches mounted on the receiver front panel, remove the rf tuner assembly from the receiver as follows:

a. Remove following knobs from shafts extending through front panel: two tuning knobs, DIAL LOCK, BAND SWITCH, and CAL ADJ.

b. Remove screws in front panel near CAL ADJ shaft securing rf tuner assembly bracket to front panel.

c. Remove bolts and nuts securing tuner to module mounting plate on bottom of chassis (fig 1–3).

d. Remove single screw near mechanical filters (fig 1–3).

e. Loosen two set screws on flexible shaft connecting front panel ANT TRIM control to variable capacitor using long-handled #6 Allen wrench. These screws are accessible from the top of the receiver, near the right end of the drum dial (as seen from front).

f. Disconnect all cables from rear of tuner assembly (fig 7–1).

g. Obtain clearance for removal of tuner assembly by removing audio frequency amplifier module and card support bracket by loosening two screws holding bracket in place on underside of module mounting plate (fig 1–3).

h. Remove screws at left end of tuner assembly (as seen from front) holding assembly to panel bracket (fig 1–2).

i. Remove locking nut on tuning shaft where shaft comes through front panel.

j. Remove rf tuner and dial assembly as a unit from front panel assembly. If necessary to operate receiver for testing purposes, tuner may be reconnected to the remainder of the receiver by reconnecting all six cables (fig 7-1) and operating in the disassembled state.

k. When reassembling rf tuner and dial assembly in place on receiver chassis, guide flexible antenna trimmer shaft on tuner assembly in place against panel shaft before fully mating the tuner assembly in place. If necessary in order to have flexible shaft coupling fully seated at both ends, turn ANT TRIM shaft back and forth two or three times before tightening locking screws in coupling. Antenna trimming capacitor should be at minimum capacity when ANT TRIM knob is at 9 o'clock position.

7-13. Repair of Front Panel Components

Potentiometers, switches and other front panel components can be replaced or resoldered as necessary with the rf tuner and dial assembly removed from chassis.

SECTION III. TESTING

7-14. Types of Test

Two types of tests are described in this section. One is a series of individual assembly tests to be performed on repaired modules or assemblies. These are described in paragraph 7-16 through 7-24. The other set of tests are intended to measure overall performance capability of a repaired receiver. This set of tests, testing am sensitivity, cw sensitivity and dynamic range is described in paragraph 7-25.

7-15. Test Equipment Required

For both types of tests, the following test equipment is required:

Nomenclature	*Technical Manual*
Signal Generator Set RF, AN/URM-25 (2 req.)	TM 11-5551
Output Meter TS-585B/U	TM 11-5017
Counter, Electronic Digital Readout AN/USM-207	TM 11-6625-700-10
Digital Voltmeter AN/GSM-64	TM 11-6625-444-15
Multimeter ME-30/U	TM 11-6625-320-12
Spectrum Analyzer TS-723/U	TM 11-5097
Test Set, Electronic Tube TV-7D/U	TM 11-6625-274-12
Attenuator HP 355B (20 db)	
Tool Kit, Elec. Equip. TK-105/G	SB 11-604
Tool Kit, Elec. Intercept Equip. TK-165/G	
Signal Generator HP 200CD	
Oscilloscope Tektronix 541	
Cable Assembly, Special Purpose, Electrical CX-11954/GR	
Card Extender, Printed Circuit	

7-16. Repaired Module Testing

Each repaired module or subassembly must be tested before return to the using activity. The sequence in which the modules are tested in the case where more than one type of module has been repaired is not important except that where the test setup makes use of the internal power supply for B+ and A+ voltages, the power supply unit itself must be tested first. Where batteries are used for B+ and A+ supplies, the power supply test need not be performed first.

7-17. Module Testing Setups

a. Material Required. For modules and assemblies other than the internal power supply, a source of B+ and A+ voltages is required. The use of batteries is recommended as shown below or, if a +24-volt source is available and the internal power supply of the receiver is known to be good, the corresponding +45-volt and +1.5-volt voltages may be taken from the receiver power supply. Other material required is shown in the applicable test setup illustrations and includes.

Item	*Quantity*
Shielded test leads, 18" to 24"	6 minimum
Jumper leads, 12" to 18"	4 minimum
Battery BA-418/U	1 (see above)
Battery BA-403/U	1 (see above)
Test fixture, IF Cards	1

b. Test Fixture. A common test fixture should be fabricated for testing repaired modules of the following types: if. amplifier unit A5, if. output unit A6, calibration oscillator unit A7, variable bfo unit A8 and audio frequency amplifier unit A9. The basic schematic diagram of the test fixture is shown in figure 7-2. Specific test instru-

ment connections are given in the applicable procedure. The +45-volt and +1.5-volt inputs to the test fixture can be taken through jumpers from a receiver power supply or from batteries, depending upon the availability of these items. The test fixture is not required for testing of a repaired power supply unit or any of the four modules of the rf tuner assembly.

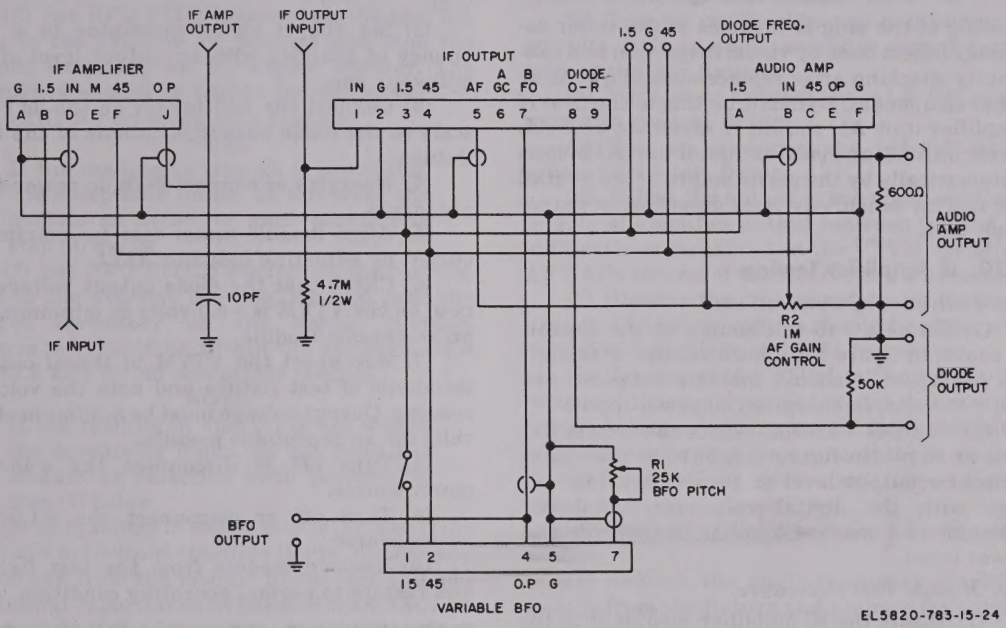

Figure 7-2. Test Fixture, Radio Receiver R-901/GR IF Cards.

7-18. Power Supply Testing

NOTE

This test requires that the power supply be loaded, either by the receiver or equivalent dummy loads.

a. Remove the cover from the power supply unit A10 in the case assembly.

b. Connect digital voltmeter to +24-volt power source and readjust level if necessary to +24 ±0.5 volts dc.

c. Set front panel POWER switch to the VEH position.

d. Connect digital voltmeter between ground and terminal 2 of transformer A10T1. Check that the voltage is in the range of +16.8 to +17.2 volts. If necessary, adjust A10R5 to bring voltage to within specified range.

e. Connect digital voltmeter between ground and the junction of A10L2 and C13. Voltage readings shall be between +1.48 and +1.52 volts.

f. Connect digital voltmeter between ground and the junction of A10L3 and A10C17. Voltage reading shall be between +43.0 and 46.0 volts. Readjust A10R10 if necessary to get correct reading.

g. Connect ac VTVM on the ac millivolts scale between ground and the junction of A10L2 and A10C13. Ripple voltage reading shall not exceed 4 millivolts.

h. Connect ac VTVM on the ac millivolt scale between ground and the junction of A10L3 and A10C17. Ripple voltage readings shall not exceed 10 millivolts.

i. Reconnect digital voltmeter to input +24-volt source and reduce voltage to +20.0 to +20.5-volts.

j. Reconnect digital voltmeter to terminal 2 of transformer A10T1. Voltage reading shall be

within +0.25-volt of reading notes in step *d* above with no adjustment of R5.

k. Turn off +24-volt source, disconnect from A10J4, and replace cover on power supply.

7-19. RF Tuner Module Testing

Testing of the plug-in modules of the tuner assembly is best done by visual inspection and continuity checking after replacement of a tube or other component. Dynamic testing of the first rf amplifier unit A1, second rf amplifier unit A2, mixer unit A3, and local oscillator unit A4 is done automatically by the performance of the overall am and cw sensitivity tests described in paragraph 7-25.

7-20. IF Amplifier Testing

a. Preliminary Connections.

(1) Connect +45-volt source to the fixture as shown in figure 7-2. Check voltage with digital voltmeter, it should indicate between +44 and +45 volts. Deenergize the power input.

(2) Connect +1.5-volt source to the test fixture as shown in figure 7-2, but set the signal generator output level to zero. Check the voltage with the digital voltmeter, it should indicate +1.4 and +1.5 volts. Deenergize the power input.

b. Module Test Procedure.

(1) Insert the if. amplifier module into the test fixture at the designated location.

(2) Set the rf signal generator to a frequency of 455 kHz with an output level of 100 microvolts rms.

(3) Connect the rf output meter to the if. output terminals of the test fixture as shown in figure 7-2.

(4) Energize both dc power supply inputs, +1.5-volt supply first.

(5) Adjust transformers A5T1 and A5T2 on module under test to provide maximum output as observed on rf output meter.

(6) Check that maximum output as read on rf output meter is 10 millivolts rms or higher for acceptable module.

(7) Turn off or disconnect the power supply inputs to the test fixture and remove the module from the test fixture.

(8) Restore the module to the normal operating condition.

7-21. IF Output Testing

a. Preliminary Connections. Repeat procedure of paragraph 7-20*a* to make preliminary connections for testing of repaired if. output unit A6.

b. Module Test Procedure.

(1) Insert the if. output module into the test fixture at the designated location (see figure 7-2).

(2) Set the rf signal generator to a frequency of 455 kHz with an output level of 7.5 millivolts rms.

(3) Connect the multimeter on the dc volts scale to the diode output terminals of the test fixture.

(4) Energize or connect both dc power supply inputs.

(5) Align module under test for maximum output by adjusting inductor A6L1.

(6) Check that the diode output voltage as read on the VTVM is −6.0-volts dc minimum for an acceptable module.

(7) Reconnect the VTVM to the af output terminals of test fixture and note the voltage reading. Output voltage must be minimum of 0.9 volts for an acceptable module.

(8) Turn off or disconnect the +45-volt power source.

(9) Turn off or disconnect the +1.5-volt power source.

(10) Remove module from the test fixture and restore to normal operating condition.

7-22. Variable Beat Frequency Oscillator Testing

a. Preliminary Connections.

(1) Connect the 1.5-volt power source to the test fixture as shown in figure 7-2 and adjust with the digital voltmeter unit the voltage is within range of +1.4 to +1.5-volts.

(2) Turn off or disconnect nominal +1.5-volt power source.

(3) Connect the +45-volt power source to the test fixture as shown in figure 7-2 and adjust with the digital voltmeter until the voltage is within the range of +45-volt power source.

(4) Turn off or disconnect the nominal +45-volt power source.

b. Module Test Procedure.

(1) Insert the variable bfo unit A8 to be tested in the designated location on the test fixture.

(2) Connect the digital frequency counter and rf output meter both to ground and to the bfo output of the test fixture.

(3) Energize or connect the +1.5-volt power source to the test fixture.

(4) Energize or connect the +45-volt power

source to the test fixture.

(5) Set BFO PITCH control on the test fixture to the mid position, and adjust A8L1 on the module under test to provide bfo frequency within the range of 454.9 to 455.1 kHz as read on the digital counter.

(6) Set BFO PITCH control on the test fixture to the extreme cw position and read the output frequency on the digital counter. The frequency should be within the range 457.5 to 458.5 kHz for an acceptable module.

NOTE

If the reading in step (6) is not within the acceptable limits, do not treat the module as defective until performing step (8) below.

(7) Set BFO PITCH control on the test fixture to the extreme ccw position and read the output frequency on the digital counter. Frequency should be within the range of 451.5 to 452.5 kHz for an acceptable module.

NOTE

If the reading in step (7) is not within the acceptable limits, do not treat the module as defective until performing step (8) below.

(8) If readings in either step (6) or step (7) or both are not within specified limits, remove the shield can from the module under test and add additional capacitance in parallel with A8C1 on the module if the frequency is too high, reduce the value of A8C1 if the frequency is too high, reduce the value of A8C1 if the frequency is too low. Added capacitance can vary from 5 to 39 picofarads. Each time a trial additional capacitor is paralleled with A8C1, repeat steps (5) through (7) above. Additional capacitance required can not exceed 39 pf for an acceptable module.

(9) Turn off or disconnect the +45-volt power source.

(10) Turn off or disconnect the +1.5-volt power source.

(11) Remove bfo module under test from the test fixture.

(12) Permanently solder in any additional capacitance found necessary in step (8) and restore module to operating condition.

7–23. Audio Frequency Amplifier Testing

a. Preliminary Connections. Use the procedures of paragraph 7–22*a* to make preliminary connections for testing of a repaired audio frequency amplifier unit A9.

b. Module Test Procedure.

(1) Insert the module to be tested in a designated location on the test fixture as shown in figure 7–2.

(2) Connect audio signal oscillator to the audio frequency output terminals of the test fixture (af amplifier input) and set oscillator for output frequency of 1000 Hz.

(3) Connect oscilloscope and multimeter on ac volts scale to audio amplifier output terminals of the test fixture.

(4) Turn on or connect the +1.5-volt power source to the test fixture.

(5) Turn on or connect the +45-volt power source to the test fixture.

(6) Adjust the output of the audio oscillator to give af amplifier output between 0.9 and 1.1 milliwatts as measured on the VTVM. Readjust AF GAIN control of the test fixture if necessary.

(7) Observe the sine waveform on the oscilloscope. Output waveform should be clean with no major distortions at 1 kHz frequency.

(8) Reconnect the VTVM to the output terminals of the audio oscillator and measure the output voltage. Voltage should be a maximum of 60 millivolts rms for an acceptable module.

(9) Turn off or disconnect the +45-volt power source.

(10) Turn off or disconnect the 1.5-volt power source.

(11) Remove the audio frequency amplifier module from the fixture and prepare for normal operation.

7–24. Calibration Oscillator Testing

Testing of a repaired calibration oscillator unit A7 requires a special test fixture, shown in figure 7–3. The equipment required in addition to the test fixture, is listed in paragraph 7–15. To test a module using the special test fixture, proceed as follows:

a. Check available +45-volt power source with dc VTVM as being within the range of +44 to +46 volts.

b. Check available +1.5-volt power source as being in range of +1.4 to +1.5 volts.

c. Insert calibration oscillator to be tested in location on the test fixture designated as 200 kHz, removing cover from module before inserting.

d. Turn on or connect the +1.5-volt power source to the test fixture.

e. Turn on or connect the +45-volt power source to the test fixture.

f. Connect oscilloscope and frequency counter to the crystal output terminals of the test fixture.

g. Adjust inductor A7L1 on the module under test to give a output frequency as indicated on the digital counter of approximately 200 kHz.

h. Adjust capacitor A7C5 on the module under test to give a output frequency within the range of 200 kHz ±15 Hz. Readjust A7L1 if necessary.

i. Measure amplitude of the oscillations on the oscilloscope. Amplitude should be 1.0 volt peak-to-peak minimum for an acceptable module.

j. Turn off or disconnect the +45-volt power source and the +1.5-volt power source in that sequence.

k. Remove module from 200 kHz position on the test fixture and install in the 1 mHz position.

l. Turn on or connect the +1.5-volt power source to the test fixture and turn on or connect the +45-volt power source to the test fixture in that order.

m. Measure the output frequency and amplitude of the output waveform on the digital counter and oscilloscope. For an acceptable module, the frequency must be 1 mHz ±50 Hz and the amplitude must be a minimum of 0.9 volt peak-to-peak.

n. Turn off or disconnect the +45-volt power source from the test fixture and turn off or disconnect the +1.5-volt power source from the test fixture in that order.

o. Remove the module under test from the 1 mHz position and install in bias test position on the test fixture.

p. Connect the dc VTVM to the bias output terminals of the test fixture.

q. Turn on or connect the +1.5-volt power source and turn or connect the +45-volt power source to the test fixture in that order.

r. Measure the bias output voltage on the VTVM. For an acceptable module, the voltage must be a minimum of −8.0-volts.

s. Turn off or disconnect the 45-volt power source and turn off or disconnect the +1.5-volt power source from the test fixture in that order.

t. Remove the module from the test fixture and restore to normal operating condition.

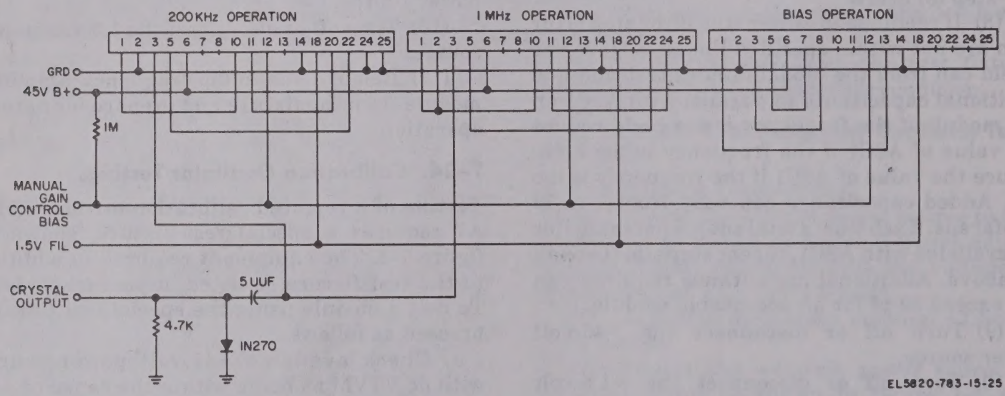

Figure 7–3. Calibration Oscillator Test Fixture.

7–25. Final Testing

a. Purpose. The final testing procedures are intended to measure the performance of a repaired receiver. A receiver that meets the minimum standards given in the individual procedures will furnish satisfactory operation, equivalent to that of a new receiver. The individual test procedures include testing of am sensitivity, cw sensitivity, am sensitivity versus supply voltage, cw sensitivity versus supply voltage, frequency calibration and dynamic range.

b. Test Equipment Required. Paragraph 7–15 lists the test equipment required for performing the final testing.

c. Test Setup. The final test setup is shown in figure 6–1. To prepare the receiver, proceed as follows:

(1) Remove the receiver from the case assembly by loosening the front panel fasteners and pulling the receiver from the case.

(2) Connect the receiver chassis to the case using the extender cable CX–11954/GR plugged into P8 on the chassis and receptable A10J8 on the case assembly.

(3) Connect a 600-ohm, ½-watt composition

resistor across the front panel AUDIO receptacle and ground and connect the output meter across the resistor as shown in figure 6–1.

(4) If the +24-volt source is available, connect the source to receptacle J4 (pins A and D) on the case assembly. If batteries are available connect the battery BA–418/U to plug P1 and battery BA–403/U to plug P2 in the battery compartment.

NOTE

For sensitivity versus supply voltage tests the +24-volt power source will require reduction to +20-volts. If the batteries are used, the supply voltage tests will require batteries that are weak, down to 1.3-volts and 38-volts respectively.

(5) Connect the test equipment as shown in figure 6–1.

d. AM Sensitivity Test Procedure.

(1) Connect the rf signal generator set input to the 50 OHM antenna receptacle through a 20 db attenuator.

(2) Set front panel control as follows:

RF GAIN control	—	maximum cw position before AGC ON
AF GAIN control	—	adjusted as part of test
FUNCTION switch	—	AM position
BAND switch	—	set as part of test
BANDWIDTH switch	—	4 KC position
ANT switch	—	50 OHM position

(3) Set POWER switch to VEH or BAT position, depending upon power source used.

(4) Turn receiver to the first band and tuning dial indicator of table 7–1.

(5) Set rf signal generator for an output of 10 microvolts with 30% amplitude modulation at 1 kHz with the output frequency the same as the receiver.

(6) Adjust the receiver tuning controls including ANT TRIM for peak output on the VTVM.

(7) Adjust the AF GAIN control for an output of 2.45-volts rms on the VTVM (10 milliwatts into a 600-ohm load).

(8) Remove the modulation from the input signal of the rf signal generator.

(9) Record the VTVM readings on a test sheet equivalent to table 7–1. Meter reading must be at least 10 db lower than that noted for step (7) above (10 milliwatts with a modulation to 1 milliwatt without modulation).

(10) Repeat steps (4) through (9) for all indicated band and tuning settings of table 7–1. Results must be greater than 10 db for all frequency settings listed in the table for an acceptable receiver.

(11) Reconnect the rf signal generator set input to the WHIP antenna receptacle on the front panel. Set front panel ANT switch to the WHIP position.

(12) Repeat steps (4) through (10) for all indicated band and tuning settings of table 7–1, insure that the rf signal generator output level is set at 30 microvolts.

e. CW Sensitivity Test Procedures.

(1) Connect the rf signal generator set input to the 50 OHM antenna receptacle through a 20 db attenuator.

(2) Set front panel controls as follows:

RF GAIN control	—	maximum cw position before AGC on
AF GAIN control	—	adjusted as part of test
FUNCTION switch	—	CW position
BAND switch	—	set as part of test
BANDWIDTH switch	—	1.5 KC position
ANT switch	—	50 OHM position

(3) Set POWER switch to VEH or BAT position, depending upon power source used.

(4) Set receiver to the receiving frequency and band called out in first line of table 7–1.

(5) Set the rf signal generator to the frequency the receiver is tuned for and set signal generator output to 5 microvolts.

(6) Set BFO PITCH control to the midposition and tune the receiver for zero beat as shown by minimum output on the VTVM.

(7) Set BFO PITCH control to the approximately 100 Hz position and set AF GAIN control to the maximum cw position.

(8) Adjust RF GAIN control to provide output reading on the VTVM of 2.45-volts rms (10 milliwatts).

(9) Set FUNCTION switch to the AM position and record the VTVM reading on the test sheet equivalent to table 7–1. Meter reading should not be less than 10 db from the reading of step (8).

(10) Repeat steps (4) through (9) for all other frequency and band settings listed in table 7–1. Initial FUNCTION switch setting is CW position.

(11) Reconnect the rf signal generator input to the WHIP receptacle on the front panel of the receiver.

(12) Repeat steps (4) through (10) except that in step (5) output level of the rf signal generator must be 15 microvolts.

f. AM Sensitivity versus Supply Voltage Test Procedure.

(1) Set the supply voltage to +20 volts if

vehicular power supply is used or +38 volts and +1.3 volts respectively if battery inputs are used.

(2) Repeat all of procedure *d* above using test sheet equivalent to table 7–1 with following changes:

(*a*) In step (5), output level of rf signal generator is set at 20 microvolts.

(*b*) In step (12), output level of rf signal generator is set at 60 microvolts.

g. CW Sensitivity versus Supply Voltage Test Procedure.

(1) Set supply voltage to +20 volts if vehicular power supply is used or +38 volts and +1.3 volts respectively if battery inputs are used.

(2) Repeat all of procedure *e* above using test sheet equivalent to table 7–1 with following changes:

(*a*) In step (5), output level of the rf signal generator is set at 10 microvolts.

(*b*) In step (12), output level of the rf signal generator is set at 30 microvolts.

h. Frequency Calibration Test Procedure.

NOTE

This test is accomplished with power sources operating at normal voltages, that is either +24 volts for vehicular supply or +45 and +1.5 volts for battery supplies.

(1) On rear of rf tuner assembly, disconnect cable from J2 and connect digital counter to connector P2 on the rf cable. Disconnect input to either antenna receptacle on front panel of receiver.

(2) Set POWER switch to VEH or BAT position, depending upon power source used.

(3) Set front panel BAND switch to 3 position and set FUNCTION switch to CAL position.

(4) Observe frequency reading on counter. For an acceptable receiver, reading must be 200 kHz ±20 Hz.

(5) Reset BAND switch to 4 position.

(6) Observe frequency reading on counter. For an acceptable receiver, reading must be 1000 kHz ±50 Hz.

(7) Disconnect digital counter from P2 and reconnect cable to receptacle J2 on rear of rf tuner assembly.

(8) Disconnect VTVM and 600 ohm load from AUDIO output receptacle and connect a 600-ohm headset to AUDIO output.

(9) Set the FUNCTION switch to CAL position and set BFO PITCH control to 0 position.

(10) Tune receiver with BAND switch on 1 position to closest zero beat in headset with dial at approximately 600 kHz.

(11) Check motion of cursor line by moving CAL ADJ knob back and forth, setting CAL ADJ control so that dial reads exactly 600 kHz. Note on result sheet similar to table 7–2 that receiver is dial calibrated at 600 kHz.

(12) Tune receiver to next highest zero beat tuning point of band 1 without readjusting CAL ADJ knob. Note on result sheet similar to table 7–2 if the dial setting is within red calibration mark setting by amount specified in table 7–2.

(13) Note in performing step (12) that no audible spurious responses should be heard until next calibration check point. Record results on sheet similar to table 7–1.

(14) Reset CAL ADJ knob setting so that cursor line is at red calibration mark with zero beat in headset.

(15) Repeat steps (12) through (14) for all indicated frequencies of band 1.

(16) Repeat steps (10) through (15) with BAND switch set at 2 position, substituting lowest frequency listing of table 7–2 in step (10).

(17) Repeat steps (10) through (15) with BAND switch set at 3 position, substituting lowest frequency listing of table 7–2 in step (10).

(18) Repeat steps (10) through (15) with BAND switch set at 4 position, substituting lowest frequency listing of table 7–2 in step (10).

(19) Repeat steps (10) through (15) with BAND switch set at 5 position, substituting lowest frequency listing of table 7–2 in step (10).

i. Dynamic Range Test Procedure.

(1) Connect receiver and test equipment in accordance with figure 6–1. Input from the rf signal generator set through 20 db attenuator is to the 50 OHM antenna receptacle.

(2) Set the rf signal generator at 4.84 mHz output with 30% amplitude modulation at 1 kHz and the signal level at 10 microvolts (1 microvolt into receiver).

(3) Tune receiver with BAND switch at 4 and FUNCTION switch on AM position to obtain maximum output on VTVM.

(4) Vary the rf signal generator output level slowly from 10 microvolts to 2.5 volts, noting VTVM reading. Modulation should be noted throughout entire range of input signal as the receiver rf stages overload.

j. Adjustment of Carrier Level Indication.

(1) Connect receiver as shown in figure 6–1 and set front panel controls as in steps (1) through (3) of procedure *d* above.

(2) Set front panel METER switch to SIG position.

(3) Set the rf signal generator for zero mod-

ulation and an output frequency of 4 mHz.

(4) Set the rf signal generator output level at 500 microvolts.

(5) Tune receiver to indicated rf signal generator frequency.

(6) Set meter on front panel to read minimum by adjusting potentiometer R4 on rear of panel near meter.

Table 7-1. AM and CW Sensitivity Tests

Band	Frequency (mHz)	50 OHM Input		WHIP Input	
		Reading In db	Required	Reading In db	Required
1	0.536		10 db or greater		10 db or greater
	0.700		do.		do.
	0.850		do.		do.
	1.000		do.		do.
	1.150		do.		do.
2	1.10		do.		do.
	1.40		do.		do.
	1.70		do.		do.
	2.00		do.		do.
	2.36		do.		do.
3	2.26		do.		do.
	2.90		do.		do.
	3.50		do.		do.
	4.20		do.		do.
	4.84		do.		do.
4	4.65		do.		do.
	6.00		do.		do.
	7.20		do.		do.
	8.50		do.		do.
	9.90		do.		do.
5	9.50		do.		do.
	12.20		do.		do.
	15.00		do.		do.
	17.80		do.		do.
	20.56		do.		do.

Table 7-2. Dial Calibration Test

Band	Calibration Frequency (mHz)	Dial Frequency (mHz)	Frequency Offset Limits (kHz)	Calibration Adj. (Check if OK)	Spurious Response Check
1	0.600		Ref		
	0.800		±2.5		
	1.000		±2.5		
2	1.200		Ref		
	1.400		±2.5		
	1.600		±2.5		
	1.800		±2.7		
	2.000		±3.0		
	2.200		±3.3		
3	2.40		Ref		
	2.60		±3.9		
	2.80		±4.2		
	3.00		±4.5		
	3.20		±4.8		
	3.40		±5.1		
	3.60		±5.4		
	3.80		±5.7		
	4.00		±6.0		
	4.20		±6.3		
	4.60		±6.9		
	4.80		±7.2		
4	5.0		Ref		
	6.0		±9.0		
	7.0		±10.5		
	8.0		±12.0		

Table 7-2. Dial Calibration Test—Continued

Band	Calibration Frequency (mHz)	Dial Frequency (mHz)	Frequency Offset Limits (kHz)	Calibration Adj. (Check if OK)	Spurious Response Check
	9.0		±13.5		
5	10.0		Ref.		
	11.0		±16.5		
	12.0		±18.0		
	13.0		±19.5		
	14.0		±21.0		
	15.0		±22.5		
	16.0		±24.0		
	17.0		±25.5		
	18.0		±27.0		
	19.0		±28.5		
	20.0		±30.0		

CHAPTER 8

DEPOT MAINTENANCE

8–1. Maintenance Responsibilities

Depot maintenance personnel are responsible for all maintenance procedures for lower category personnel as described in Chapters 4, 6 and 7. In addition, depot personnel are to perform all overhaul and rebuild operations of Radio Receiver R–901/GR. No special instructions are required for overhaul or rebuilding of the receiver or its subassemblies other than for the rf tuner assembly. Instructions for this assembly are given in paragraph 8–2. Mechanical alignment of the rf tuner assembly following reassembly is described in paragraph 8–3.

8–2. RF Tuner Assembly Parts Replacement

a. Removal From Receiver. Removal of the rf tuner and dial assembly from the receiver is described in paragraph 7–12.

b. Disassembly (figure 8–1).

NOTE

The rf tuner and dial assembly should be disassembled only to the extent required to replace defective parts. Follow instructions given below to the level required to gain access to a defective part or unit.

(1) Remove tuning drive assembly as follows:

(*a*) Loosen set screws on dial gear and slide gear forward on dial shaft until clear of shaft.

(*b*) Loosen two set screws on tuning capacitor gear and slide gear forward on shaft until free of idler.

(*c*) Loosen set screws of tuning drive gear so that gear is loose on shaft.

(*d*) Remove screws in linkage from CAL ADJ shaft to calibration cursor on dial assembly.

(*e*) Remove two screws supporting band switch bracket to body of rf tuner assembly and allow bracket to swing clear.

(*f*) Remove screws securing tuning drive assembly to dial assembly and rf tuner assembly, move tuning drive assembly outward from rf tuner assembly body until gears on tuning capacitor shaft are clear of shaft.

(2) Remove dial assembly by removing screws and nuts at left side of receiver and lifting dial assembly out (see figure 8–2).

(3) Remove right side connector bracket mounting screws and dismount bracket to replace a connector on this bracket.

(4) Remove left side connector bracket mounting screws and dismount bracket to replace a connector on this bracket.

(5) Loosen and pull forward top and bottom retaining rods of band switch to gain access to wafers requiring replacement. Rods are loosened and tightened from right side of tuner assembly (see figure 8–1).

c. Reassembly. Reassembly is in the reverse order of disassembly as given in *b* above. Wherever a shaft is inserted into a bushing, the shaft should be given a light application of instrument grease or silicon grease. The tire-disc engagement of the dial lock on the tuning drive assembly should not be lubricated.

8–3. Mechanical Tuning Dial Alignment

To align the tuning dial against the tuning capacitor, proceed as follows:

(1) Set tuning capacitor with the tuning dial so that the capacitor tuning plates are fully engraged (rotor plates fully in the stator plates and up against the mechanical limit stop).

(2) Set CAL ADJ shaft so that it is at the middle of full travel (cursor line is at the center of the window area).

(3) Loosen the two set screws in the dial gear at the right end of the rf tuner and dial assembly.

(4) Hold dial gear engaged against idler gear and rotate the dial drum by hand until lowest frequency marking is in line with cursor line.

(5) Lock the set screws on the dial gear.

(6) Check the setting of the dial by performing dial calibration test (paragraph 7–25*h*). If all the readings are consistently on the high or low side for the frequency deviation, repeat steps (1) through (3) and rotate the dial drum slightly in the direction that will counter the observed frequency deviation and lock the set screws on the dial gear.

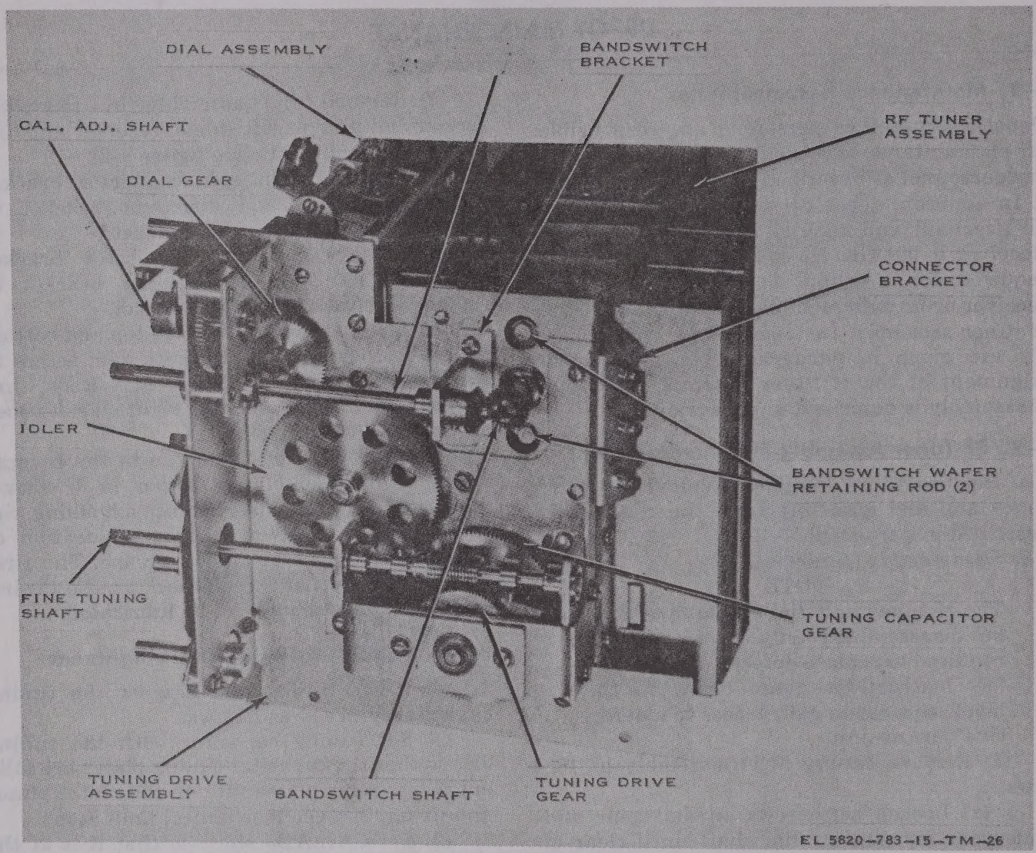

Figure 8-1. RF Tuner and Dial Assembly.

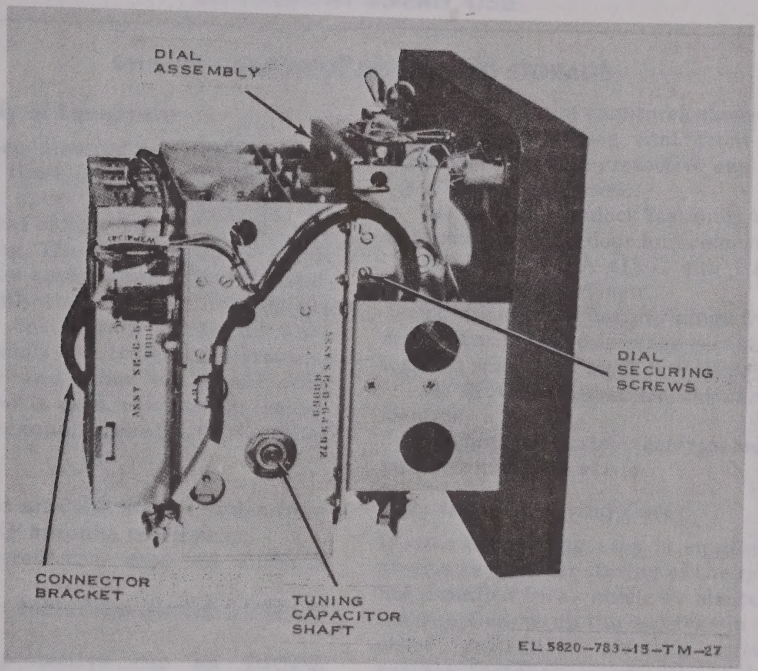

Figure 8-2. Radio Receiver R-901/GR, Left Side.

CHAPTER 9

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

9–1. Disassembly of Equipment

Disassembly procedures for vehicular installations differ from those for man-portable installations to some extent. The differences fall mainly in the areas of battery installations and physical mounting. The instructions for disassembly given below apply to both types of installations. Follow only the pertinent instructions applying to the installation conditions that exist. For disassembly instructions pertaining to the antennas and other equipment with which the receiver is used, refer to the applicable instruction manuals issued with the other equipment.

a. Cables.

(1) Disconnect antenna lead-in cables from 50 OHM and WHIP antenna receptacles.

(2) Replace protective caps on antenna receptacles.

(3) Disconnect cable from DIODE OUTPUT receptacle.

(4) Replace protective cap on DIODE OUTPUT connector.

(5) If in vehicular use, disconnect power cable from receptacle in battery compartment and replace cover on battery compartment by securing with four turnlocks.

(6) Disconnect headset from AUDIO receptacle.

(7) Clean all cables and connectors. Stow antenna cables and vehicular power supply in accordance with applicable instructions for these units. Stow headset in accessories canvas carrying case if supplied.

b. Receiver.

(1) Remove receiver from mounting base if so installed by backing off front clamps on mounting base and lifting receiver forward and up from base.

(2) Check that POWER and DIAL LIGHT switches are both set to OFF position.

(3) Check that DIAL LOCK is set and that tuning control can not be turned.

(4) Set both AF GAIN and RF GAIN controls to maximum counterclockwise position.

(5) Check to see that front panel VEH POWER receptacle protective cap is secure.

c. Internal Batteries.

(1) Loosen turnlock fasteners securing battery compartment door and remove door.

(2) Remove BA–418/U and BA–403/U batteries from compartment.

(3) Disconnect battery plugs from batteries and fasten plugs to stowage receptacle on right wall (as seen from rear) of compartment.

(4) Stow batteries in designated storage location.

(5) Replace battery compartment door and secure with turnlocks.

9–2. Use of Carrying Case

If canvas carrying case is supplied, it should always be used for storing of the receiver when not installed in a vehicle or shelter. If case is not supplied, wrap the receiver in tarpaulin or other protective covering between man-portable installations or vehicular installations.

9–3. Repacking for Shipment or Limited Storage

The exact procedure for repackaging depends upon materials available and the conditions under which the receiver is to be shipped or stored. If the original packing materials in which the receiver was received are still available, they should be used in the reverse order of that given in paragraph 2–1*b*. If original packing materials are no longer available, repackage in equivalent materials following figure 2–1, and noting the following items in particular:

a. Place cushioning material inside of canvas carrying case (if available) around receiver.

b. Place corrugated cardboard pads around carrying case or receiver (if no carrying case is available) to prevent sliding of receiver within inner carton.

c. Seal inner carton with tape and identify the carton.

d. Line outer carton with waterproof paper before placing inner carton within it.

e. Seal waterproof paper barrier before sealing outer carton with waterproof tape. Identify outer carton.

f. Secure cartons in packing case equivalent to original, inserting blocking material if necessary to keep carton from sliding around in the case.

g. Apply approved sealing bands around case when cover has been nailed closed; if receiver is to be transshipped between theaters or major commands.

h. Mark case in accordance with MIL-STD-129.

Section II. DEMOLITION TO PREVENT ENEMY USE

9-4. Authority for Demolition

Demolition of the receiver will be accomplished only upon the order of the commander. The destruction procedures outlined in paragraph 9-5 will be used to prevent use of the receiver.

9-5. Methods of Destruction

Use any or all of the following methods to destroy the receiver as available time and the tactical situation allow.

a. Smash. Smash all front panel controls, indicators and connectors with heaviest tools on hand if time does not allow removal of receiver from housing assembly. If time allows, remove receiver from housing assembly and smash interior of set using sledges, axes, hammers or crowbars. Remove plug-in modules if time allows and smash on hard surface with heel or stones.

b. Cut. Cut all cords and cables, both exterior and within the receiver. Use axes, knives, machetes or handaxes.

c. Burn. Burn cords and technical manuals using gasoline, kerosene, oil, flamethrowers or incendiary grenades.

d. Bend. Bend panels, cabinet and chassis.

e. Explode. If explosives are necessary, use firearms, powder charges or fragmentation grenades.

f. Dispose. Bury or scatter destroyed parts in slit trenches or foxholes, or throw them into rivers, streams, or lakes.

CHAPTER 10

PERFORMANCE TESTS FOLLOWING OVERHAUL OR MAJOR REPAIR

10-1. Applicability of Inspection Standards

The tests outlined in this chapter are designed to measure the performance capability of a Radio Receiver R-901/GR. Receivers that meet the minimum standards stated in the tests will furnish satisfactory operation, equivalent to that of new equipment.

10-2. Test Equipment Required

The following equipments, or suitable equivalents, will be employed in determining compliance with the requirements of this specific Standard.

a. Test Equipment.

Equipment	*Technical Manual*	*Common Name*
Signal Generator Set, RF AN/URM-25	TM 11-5551	RF Signal Generator
Counter, Electronic Digital Readout AN/USM-207	TM 11-6625-700-10	Frequency Counter
Output Meter TS-585B/U	TM 11-5017	Output Meter
Attenuator HP 355B	Commercial	Attenuator
Multimeter ME-26/U	TM 11-6625-200-15	VTVM
Signal Generator AN/URM-127	TM 11-6625-683-15	Audio Oscillator
Spectrum Analyzer TS-723D/U	TM 11-5097	Spectrum Analyzer
Voltmeter, Electronic ME-30/U	TM 11-6625-320-12	VTVM
Digital Voltmeter AN/GSM-64	TM 11-6625-444-15	Digital Voltmeter

b. Additional Equipment.

Power Supply, Power Design 3650S or equivalent
Power Supply, Oregon A3 or equivalent
Extender Cable CX-11954/GR
Resistor, 620 ohm, ½ watt ±5% (A)
Resistor, 51K, ½ watt, ±5%
Resistor, 3.3 ohm, 2 watt (B)
Resistor, 2.2K, 2 watt (B)

NOTES

(A) Required only if output meter (ac VTVM) is H-P-400D; TS-585B/U has internal input impedance of correct value for tests.

(B) Required only as dummy loads for power supply testing if Radio Receiver R-901/GR itself is not used as loading on power supply.

10-3. General Test Requirements for Radio Receiver R-901/GR

There are several categories of tests to be performed on Radio Receiver R-901/GR. In approximately half of these tests, the receiver is checked as complete unit with no disassembly. In the other tests, the receiver is removed from its case for the purpose of obtaining access to particular adjustments points or measuring locations, but no further disassembly beyond removal from the case usually is required. Testing will be simplified if the tests are performed in the sequence given with changes to front panel controls made only as given in the test sequence.

a. Tests and Test Setups. The tests to be performed in the sequence in which they should be performed along with the corresponding test setups are:

Test	*Proc. Para.*	*Test Setup*
Sensitivity, AM	10-5*a*	Fig. 10-1
Sensitivity, CW	10-5*b*	Fig. 10-1
Frequency calibration	10-5*c*	Fig. 10-2
Intermediate frequency	10-5*d*	Fig. 10-3
AGC/AVC characteristics	10-5*e*	Fig. 10-4
Audio output power level	10-5*f*	Fig. 10-5
Audio output level (battery operation)	10-5*g*	Fig. 10-6
Audio harmonic distortion	10-5*h*	Fig. 10-5
Audio response	10-5*i*	Fig. 10-7
Diode Output	10-5*j*	Fig. 10-8
Power Supply (DC to dc Converter)	10-5*k*	Fig. 10-9

b. Removal From Case. Where the test procedure calls for removal of the receiver from its case, unless otherwise stated in the applicable test procedure, proceed as follows:

(1) Loosen front panel screws securing receiver chassis in case.

(2) Slide receiver forward until free of case.

(3) Connect extender cable CX11954/GR between connector P8 on rear of receiver chassis and receptacle A10J8 on case assembly.

(4) Connect variable output dc power supply (0 to 45 volts) to pins A and D of receptacle J4 in battery compartment of case with positive (+) terminal of power supply to pin A and negative (−) terminal of power supply to pin D. Unless otherwise specified, set power supply output to 24 ±0.5 volts with receiver POWER switch to OFF position.

c. Other Test Conditions.

(1) Whenever measurements are made at AUDIO receptacle on receiver front panel using an instrument such as the ac VTVM H-P-400D, a 620-ohm ½-watt resistor must be connected across the receptacle terminals for proper loading. When using the TS-585B/U VTVM (output meter), the additional resistor is not required because of the internal impedance of the meter.

(2) Unless otherwise stated, all signal injection into the receiver from a signal generator is through the 20db attenuator to allow operation of the signal generator at higher input levels and thus in the ranges where calibration is more accurate. Under these input conditions, the output voltage level of the signal generator is always set at 10 times the desired input level at the antenna receptacle of the receiver.

(3) Unless otherwise stated in the applicable test procedure, the maximum setting of the receiver RF GAIN control is always the full clockwise position before the AGC position.

10-4. Tests on Radio Receiver R-901/GR

a. AM Sensitivity Test. Make the overall am sensitivity test as follows:

(1) Connect receiver and test equipment as indicated in figure 10-1. Connect power supply to pins A and D of J4 in battery compartment per para 10-4*b*(4).

(2) Check receiver POWER switch to OFF position.

(3) Energize power supply and set for output of 24 ±0.5 volts.

(4) Connect output of rf signal generator to 50 OHM input terminal of receiver through 20db attenuator.

(5) Set front panel controls of receiver as follows:

FUNCTION switch	—	AM
BANDWIDTH switch	—	1.5 KC
ANT switch	—	50 OHM
RF GAIN control	—	approximately one-third from ccw position; to be adjusted as part of test procedure.

(6) Set receiver POWER switch to VEH position.

(7) Tune receiver to 0.536 MHz using tuning dial and BAND switch.

(8) Set rf signal generator for output of 10 microvolts with 30% amplitude modulation at 1 kHz and at output frequency of 0.536 MHz.

(9) Adjust receiver tuning control and ANT TRIM control to produce maximum indication (peak output) on ac VTVM connected to AUDIO output receptacle. Adjust RF GAIN control as required to provide maximum indication without over driving receiver as other controls are adjusted.

(10) Adjust AF GAIN control on receiver to provide ac VTVM indication of 2.45 volts rms. This is equivalent to 10 milliwatts into 600-ohm load.

(11) Remove modulation from input signal from rf signal generator and note ac VTVM indication. For acceptable receiver, meter indication must be at least 10db below that noted in step (10) above.

(12) Reconnect rf signal generator input through 20db attenuator to WHIP antenna receptacle on front panel. Reset rf signal generator to provide 0.536 MHz output signal at 30 microvolts with 30% amplitude modulation at 1 kHz. Reset receiver ANT switch to WHIP position. Set receiver POWER switch to VEH position.

(13) Adjust receiver tuning control and ANT TRIM control to provide maximum indication (peak output) on ac VTVM.

(14) Adjust AF GAIN control on receiver to provide ac VTVM indication of 2.45 volts rms, equivalent to 10 milliwatts into 600-ohm load.

(15) Remove modulation from input signal from rf signal generator and note ac VTVM indication. For acceptable receiver, meter indication must be at least 10db below that noted in step (14) above showing $\frac{\text{Signal + Noise}}{\text{Noise}}$ ratio more than 10 db.

(16) Set receiver POWER switch to OFF position and deenergize power supply.

b. CW Sensitivity Test. Make the overall cw sensitivity test following completion of the am

sensitivity test as follows:

(1) Connect receiver and test equipment as indicated in figure 10–1. Connect power supply to pins A and D of J4 in battery compartment per para 10–4*b*(4) after disconnecting and removing batteries BA–403/U and BA–418/U from receiver.

(2) Check receiver POWER switch in OFF position and energize power supply, setting for output of +24 ±0.5 volts.

(3) Connect rf signal generator output to 50 OHM antenna receptacle on receiver front panel through 20db attenuator.

(4) Set receiver front panel controls as follows:

RF GAIN control	—	maximum cw position before AGC ON position
FUNCTION switch	—	CW
BANDWIDTH switch	—	1.5 KC
ANT switch	—	50 OHM

(5) Set receiver POWER switch to VEH position.

(6) Tune receiver to 0.536 MHz using tuning dial and BAND switch.

(7) Set rf signal generator for output of 5 microvolts at output frequency of 0.536 MHz.

(8) Set receiver BFO PITCH control to midposition and tune receiver for zero beat as indicated by minimum indication of ac VTVM.

(9) Set BFO PITCH control to approximately 1000 Hz position (plus or minus) and set AF GAIN control to optimum (S+N)/N ratio.

(10) Adjust receiver RF GAIN control to provide indication on ac VTVM of 2.45 volts rms (10 milliwatts into 620-ohm load).

(11) Set receiver FUNCTION switch to AM position and note indication of ac VTVM. For acceptable receiver, VTVM indication should be not less than 10db below that of step (10) above.

(12) Set receiver POWER switch to OFF position and reconnect rf signal generator output through 20db attenuator to WHIP antenna receptacle on receiver front panel. Reset ANT switch to WHIP position.

(13) Set receiver POWER switch to VEH position and tune receiver to 0.536 MHz using tuning dial and BAND switch.

(14) Set rf signal generator for output of 15 microvolts at output frequency of 0.536 MHz. Set receiver BFO PITCH control to midposition and FUNCTION switch to CW position.

(15) Tune receiver for zero beat as indicated by minimum indication of ac VTVM.

(16) Set BFO PITCH control to approximately 1000 Hz position (plus or minus) and set AF GAIN control to optimum (S+N)/N.

(17) Adjust receiver RF GAIN control to provide indication on ac VTVM of 2.45 volts rms.

(18) Set receiver FUNCTION switch to AM position and note VTVM indication. For acceptable receiver, VTVM indication should be not less than 10db below that of step (17) above.

(19) Set receiver POWER switch to OFF position. If sensitivity results are satisfactory, proceed to frequency calibration test.

c. Frequency Calibration Test. To make the frequency calibration test, proceed as follows:

(1) Remove receiver from case and connect extender cable between case and receiver chassis per para 10–4*b*, steps (1) through (4), including connection to power supply.

(2) Complete remainder of test setup as shown in figure 10–2 by disconnecting rf cable from receptacle J2 on receiver and installing cable from connector P2 to frequency counter.

(3) Check receiver POWER switch to OFF position and energize power supply, setting power supply output voltage to +24 ±0.5 volts.

(4) Set receiver POWER switch to VEH position.

(5) Set receiver BAND switch to 3 position. Set FUNCTION switch to CAL position. Note indication of frequency counter. For acceptable receiver, frequency output of calibration oscillator must be 200 kHz ±20 Hz.

(6) Set BAND switch to 4 position. Note indication of frequency counter. For acceptable receiver, frequency output of calibration oscillator must be 1000 kHz ±50 Hz.

(7) Set receiver POWER switch to OFF position and disconnect frequency counter cable from P2. Reconnect cable P2 to J2 on rear of rf tuner assembly. Do not remove extender cable between receiver chassis and case and reinsert receiver in case as receiver is to be left in open condition for intermediate frequency (if) test that follows.

d. Intermediate Frequency Test. Make the intermediate frequency test following the calibration oscillator test as follows:

(1) With receiver in open condition, extender cable connected, and power supply connected per para 10–4*b*, complete the test setup as shown in figure 10–3. The connection to the if input, shown in figure 10–3, is made by connecting the lead from the signal generator through the 20db attenuator to connector P3. The cable terminated by P3 must be disconnected from J3 on the rf tuner assembly for the signal generator input lead to be connected to it.

(2) Set receiver POWER switch to VEH

position.

(3) Set BANDWIDTH switch to 4 KC position.

(4) Set receiver FUNCTION switch to AM position.

(5) Set rf signal generator at output frequency of 455 kHz, amplitude modulated with 1 kHz at 30%. Slowly increase output voltage of rf signal generator until deflection of ac VTVM connected to AUDIO output receptacle is noted. Adjust AF GAIN as needed.

(6) Tune rf signal generator output frequency to obtain maximum deflection on ac VTVM. Note rf signal generator output frequency at maximum deflection point as indicated by frequency counter. For acceptable receiver, frequency should be 455 ±2 kHz.

(7) Reset front panel BANDWIDTH switch to 1.5 KC position and repeat step (6) above. Acceptable if frequency for 1.5 kHz bandwidth is also 455 ±2 kHz.

(8) Set receiver POWER switch to OFF position.

(9) Disconnect power inputs from J4 in battery compartment. Disconnect extender cable from receiver chassis to case. Reinsert receiver in case and secure in place with front panel screws.

e. AGC/AVC Characteristics Test. The measurement of AGC characteristics may be made at any time, although it is recommended that this test be performed in the sequence given in this chapter. Perform the AGC/AVC characteristics test as follows:

(1) Connect receiver and test equipment as indicated in figure 10–4. Connect power supply to pins A and D of J4 in battery compartment per para 10–4*b*(4).

(2) Check receiver POWER switch in OFF position and energize power supply, setting for output of +24 ±0.5 volts.

(3) Connect rf signal generator output to 50 OHM antenna receptacle on receiver front panel through 20db attenuator.

(4) Set receiver front panel controls as follows:

RF GAIN control	—	AGC ON
FUNCTION switch	—	AM
BANDWIDTH switch	—	4 KC
ANT switch	—	50 OHM

(5) Set receiver POWER switch to VEH position.

(6) Tune receiver to 4.84 MHz using tuning control and BAND switch.

(7) Set rf signal generator at nominal output frequency of 4.84 MHz, with 1 kHz amplitude modulation at 30%. Set rf signal generator output voltage at 100 microvolts (10 microvolts into receiver 50 OHM receptacle).

(8) Tune rf signal generator output frequency to obtain maximum indication on ac VTVM.

(9) Adjust receiver AF GAIN control to obtain ac VTVM indication of 2.45 volts rms (10 milliwatts into 600-ohm load).

(10) Slowly increase rf signal generator output voltage from 100 microvolts (10 microvolts into receiver) to 2.5 volts (0.25 volt into receiver) while monitoring indication of ac VTVM. Audio output level should not vary more than 10db from level set in step (9) above for acceptable receiver.

(11) Set receiver POWER switch to OFF position.

f. Audio Output Power Level Test. The audio output power level test is one of four tests to determine the audio response of the receiver. Make the test as follows:

(1) Connect receiver and test equipment as shown in figure 10–5. Connect power supply to pins A and D of J4 in battery compartment per para. 10–4*b*(4).

(2) Check receiver POWER switch in OFF position and energize power supply. Set output voltage of power supply at +32 ±0.5 volts.

(3) Connect rf signal generator output to 50 OHM receptacle on front panel of receiver through 20db attenuator.

(4) Set receiver front panel controls as follows:

RF GAIN control	—	maximum cw position before AGC ON
FUNCTION switch	—	AM
BANDWIDTH switch	—	4 KC

(5) Set receiver POWER switch to VEH position.

(6) Tune receiver to band 1 with BAND switch and at 0.536 MHz.

(7) Adjust rf signal generator output to provide 10-microvolt output voltage at 0.536 MHz, 30% amplitude-modulated at approximately 1000 Hz.

(8) Tune receiver to provide maximum audio output as indicated by ac VTVM. Readjust receiver RF GAIN and AF GAIN controls as required to provide maximum audio output as indicated by ac VTVM. For acceptable receiver, output must be not less than 20 milliwatts.

(9) Decrease power supply output voltage from 32 volts to 20 ±0.5 volts and repeat steps (6) through (8) above. For acceptable receiver, output must be not less than 20 milliwatts.

(10) Reset receiver BAND switch to 2 posi-

tion and tune to 1.1 MHz. Repeat steps (7) through (9) above except that rf signal generator output frequency is set to 1.1 MHz. For acceptable receiver, output power for both levels of power supply voltage must be not less than 20 milliwatts.

(11) Reset receiver BAND switch to 3 position and tune to 2.26 MHz. Repeat steps (7) through (9) above except that rf signal generator output frequency is set to 2.26 MHz. For acceptable receiver, output power for both levels of power supply voltage must be not less than 20 milliwatts.

(12) Reset receiver BAND switch to 4 position and tune to 4.65 MHz. Repeat steps (7) through (9) above except that rf signal generator output frequency is set to 4.65 MHz. For acceptable receiver, output power for both levels of power supply voltage must be not less than 20 milliwatts.

(13) Reset receiver BAND switch to 5 position and tune receiver to 9.5 MHz. Repeat steps (7) through (9) above except that rf signal generator is set to 9.5 MHz. For acceptable receiver, output power for both levels of power supply voltage must be not less than 20 milliwatts.

(14) Set receiver POWER switch to OFF position. Deenergize power supply and disconnect from connector J4 in battery compartment to prepare for next test which measures audio output power under low battery voltage conditions.

g. Audio Output Level (Battery Operation) Test. Make the test to determine audio output level under low battery voltage conditions as follows:

(1) Connect receiver and test equipment as shown in figure 10–6. One power supply (capable of output voltages up to 40 volts and higher) is connected to battery plug P1 in battery compartment following polarity markings on plug. The other power supply is connected to battery plug P2 in battery compartment following polarity markings on plug.

(2) Check receiver POWER switch in OFF position and energize both power supplies. Set power supply connected to P1 at output voltage of 38 ±0.5 volts. Set power supply connected to P2 at output voltage of 1.3 ±0.01 volts.

(3) Set receiver front panel controls as follows:

RF GAIN control	—	maximum cw position before AGC ON
FUNCTION switch	—	AM
BANDWIDTH switch	—	4 KC

(4) Set receiver POWER switch to BAT position.

(5) Set receiver BAND switch to 1 position and tune receiver to 0.536 MHz.

(6) Adjust rf signal generator to provide 10-microvolt output voltage at 0.536 MHz, 30% amplitude-modulated at approximately 1000 Hz.

(7) Tune receiver to provide maximum audio output as indicated by ac VTVM. Readjust receiver RF GAIN and AF GAIN controls as required to provide maximum audio output as indicated by ac VTVM. For acceptable receiver, output must be not less than 10 milliwatts.

(8) Reset receiver BAND switch to 2 position and tune receiver to 1.1 MHz. Repeat steps (6) and (7) above except that rf signal generator output frequency is set to 1.1 MHz. For acceptable receiver, audio output power must be not less than 10 milliwatts.

(9) Reset receiver BAND switch to 3 position and tune receiver to 2.26 MHz. Repeat steps (6) and (7) above except that rf signal generator output frequency is set to 2.26 MHz. For acceptable receiver, audio output power must be not less than 10 milliwatts.

(10) Reset receiver BAND switch to 4 position and tune receiver to 4.65 MHz. Repeat steps (6) and (7) above except that rf signal generator output frequency is set to 4.65 MHz. For acceptable receiver, audio output power must be not less than 10 milliwatts.

(11) Reset receiver BAND switch to 5 position and tune receiver to 9.5 MHz. Repeat steps (6) and (7) above except that rf signal generator output frequency is set to 9.5 MHz. For acceptable receiver, audio output power must be not less than 10 milliwatts.

(12) Set receiver POWER switch to OFF position. Deenergize both power supplies and disconnect from battery plugs P1 and P2 respectively in battery compartment.

h. Audio Harmonic Distortion Test. The audio harmonic distortion present in the audio output is measured as follows:

(1) Connect receiver and test equipment as shown in figure 10–5. Connect rf signal generator output through 20db attenuator to 50 OHM input receptable of the receiver. Connect power supply to pins A and D of J4 in battery compartment per para 10–4*b*(4).

(2) Check receiver switch to OFF position and energize power supply. Set power supply output voltage to 24 ±0.5 volts.

(3) Set receiver front panel controls as follows:

RF GAIN control	—	AGC ON
FUNCTION switch	—	AM
BANDWIDTH switch	—	4 KC
BAND switch	—	BAND 4
ANT switch	—	50 OHM

(4) Set receiver power switch to VEH position.

(5) Tune receiver to 4.84 MHz.

(6) With test equipment energized, set audio oscillator to output frequency of 1000 Hz. Set audio oscillator output level to provide 30% modulation as indicated on the modulation meter of the rf signal generator.

(7) Adjust rf signal generator to provide output of 100 microvolts (10 microvolts into receiver) and tune output frequency of rf signal generator to provide maximum indication on ac VTVM.

(8) Adjust receiver AF GAIN control to provide output as indicated on an VTVM of 10 milliwatts (+10dbm).

(9) Measure distortion present in output of receiver using distortion analyzer. For acceptable receiver, maximum distortion at 10 milliwatt output level is 7%.

(10) Set receiver POWER switch to OFF position. Disconnect all test equipment in preparation for next test (audio response) which requires removal of receiver from case.

i. Audio Response Test. Make the audio response test as the last in the series of tests of the audio capabilities of the receiver. Make the test as follows:

(1) Remove receiver from case by loosening front panel securing screws and sliding receiver out of case. Connect extender cable between receiver and case per para 10–4.

(2) Complete the test set as shown in figure 10–7. The connection to the receiver from the audio oscillator is made by removing if output unit A6 from its socket on the if assembly and connecting a cable from the audio oscillator to the AF GAIN control potentiometer R2 on the front panel of the receiver.

(3) Set receiver front panel controls as follows:

FUNCTION switch	—	AM
RF GAIN control	—	maximum ccw (off)
AF GAIN control	—	maximum cw

(4) Set receiver POWER switch to VEH position.

(5) Adjust audio oscillator output frequency to 1000 Hz and set oscillator output level at 200 millivolts rms. Adjust receiver AF GAIN control to provide indication on ac VTVM of 10 milliwatts (2.45 volts rms).

(6) Holding the output voltage of the audio oscillator constant at 200 millivolts rms and without changing setting of receiver AF GAIN control, set audio oscillator in turn to each test frequency listed below. For each test frequency listed, ac VTVM indication must provide indication of output in db within limits shown for acceptable receiver.

Test Frequency, Hz	*Required Response, db*
250	−5 ±2
400	−2 ±2
1000	0 (+10 dbm) − reference
2500	−2 ±2
3500	−5 ±2
5000	−10 or greater
7000	−15 or greater

(7) Set receiver POWER switch to OFF position. Deenergize test equipment. Disconnect test cable from audio oscillator AF GAIN potentiometer R2 and replace if output module A6 in socket XA6. Replace cover on if assembly and restore receiver to normal in case with front panel screws secured.

j. Diode Output Test. The diode output test may be conducted at any time although for the purpose of depot inspection it is recommended that it be performed after all audio output tests have been conducted. Perform the diode output test as follows:

(1) Connect the receiver and test equipment as shown in figure 10–8. The input to the receiver is to the 50 OHM receptacle from the signal generator through the 20db attenuator. Connect the receiver to the power supply in accordance with para 10–4*b*(4).

(2) Check receiver POWER switch in the OFF position and set power supply for output voltage of 24 ±0.5 volts.

(3) Set receiver front panel controls as follows:

FUNCTION switch	—	AM
BANDWIDTH switch	—	4 KC
ANT switch	—	50 OHM
RF GAIN control	—	maximum cw position before AGC ON
AF GAIN control	—	approximate midposition

(4) Set receiver POWER switch to VEH position.

(5) Set rf signal generator for output voltage of 10 microvolts to provide 1 microvolt into 50 OHM antenna receptacle. Set rf signal generator for 30% amplitude modulation at 1 kHz. In turn, set rf signal generator output frequency at each value listed below. For each rf signal generator output frequency, tune receiver using BAND switch, tuning control and ANT TRIM control to obtain maximum ac

VTVM indication. Read dc VTVM for each maximum ac VTVM indication. For acceptable receiver, diode output as indicated by dc VTVM must be not less than −2.5 volts dc.

Test Frequency, MHz	Receiver Band	Required dc volts
0.560	1	−2.5 or greater
0.850	1	−2.5 or greater
1.150	1	−2.5 or greater
1.11	2	−2.5 or greater
1.65	2	−2.5 or greater
2.35	2	−2.5 or greater
2.25	3	−2.5 or greater
3.50	3	−2.5 or greater
4.80	3	−2.5 or greater
4.6	4	−2.5 or greater
7.2	4	−2.5 or greater
9.9	4	−2.5 or greater
9.5	5	−2.5 or greater
15.0	5	−2.5 or greater
20.0	5	−2.5 or greater

(6) Set receiver POWER switch to OFF position. Deenergize test equipment and disconnect from receiver.

k. Power Supply Test. The power supply is tested for proper output voltages and for ripple content. Make the test as follows:

(1) Remove receiver from case by loosening front panel screws and sliding receiver from case.

(2) Within case, remove cover from power supply unit A10.

(3) If receiver is to be used as load on unit A10 as shown in figure 10–9, connect bench supply to connector J4 in battery compartment in accordance with para 10–4*b*(4) and connect extender cable between connector P8 on receiver chassis and connector A10J8 on case. If receiver is not to be used as load, proceed as described in step (4) below.

(4) Connect dummy loads and power input as follows:

(*a*) 3.3-ohm, 2-watt resistor to 1.5-volt output and to ground

(*b*) 2.2K, 2-watt resistor to 45-volt output and to ground

(*c*) Bench power supply to input of dc to dc converter by applying positive (+) lead from power supply to FL1 of dc to dc converter and negative (−) lead from power supply to ground.

(5) If receiver is used as load on unit A10, check receiver POWER switch to OFF position and adjust bench power supply to output of 20 ±0.5 volts. If dummy loads are used, temporarily disconnect positive lead from unit A10 and set power supply to output of 20 ±0.5 volts.

(6) If receiver is used as load, set POWER switch to VEH position. If dummy loads are used, connect clip lead from positive terminal of bench power supply to FL1.

(7) Connect dc VTVM between nominal 1.5-volt output point and ground. For acceptable receiver, VTVM indication should be between +1.4 and +1.6 volts.

(8) Disconnect dc VTVM and connect ac VTVM to nominal 1.5-volt output point. For acceptable receiver, ripple indication on VTVM should be less than 4 millivolts.

(9) Disconnect ac VTVM and connect dc VTVM between nominal 45-volt output point and ground. For acceptable receiver, VTVM indication should be between +43.0 and +47.0 volts.

(10) Disconnect dc VTVM and connect ac VTVM to nominal 45-volt output point. For acceptable receiver, ripple indication on VTVM should be less than 10 millivolts. Disconnect VTVM.

(11) Reset bench power supply for output of 32 ±0.5 volts and repeat steps (7) through (10) above. For acceptable receiver, all indications should be as noted in above steps.

(12) Set receiver POWER switch to OFF position or disconnect input leads from bench power supply as applicable. Disconnect all loads, extender cable, etc as applicable and restore receiver to normal operating condition with cover on power supply unit A10 and receiver secured in case.

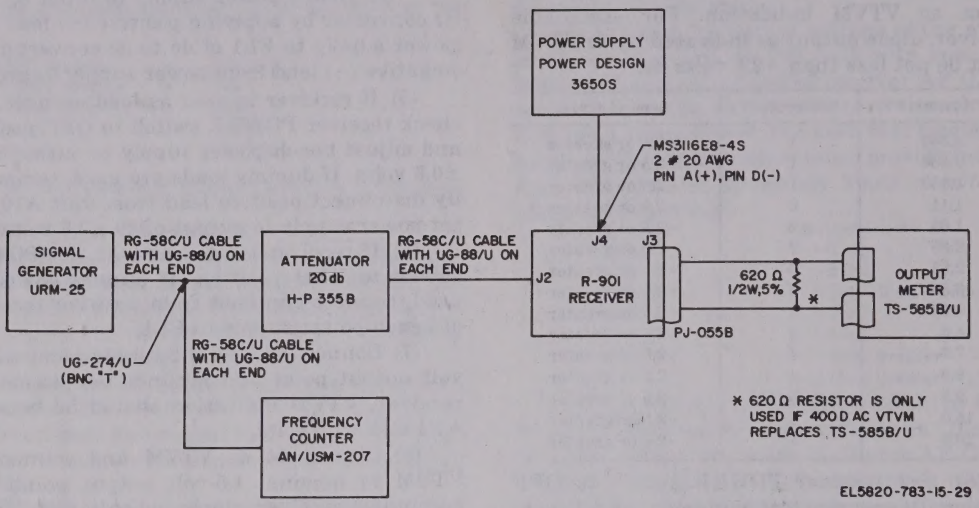

Fig. No. 10-1. AM Sensitivity and CW Sensitivity Test Setup.

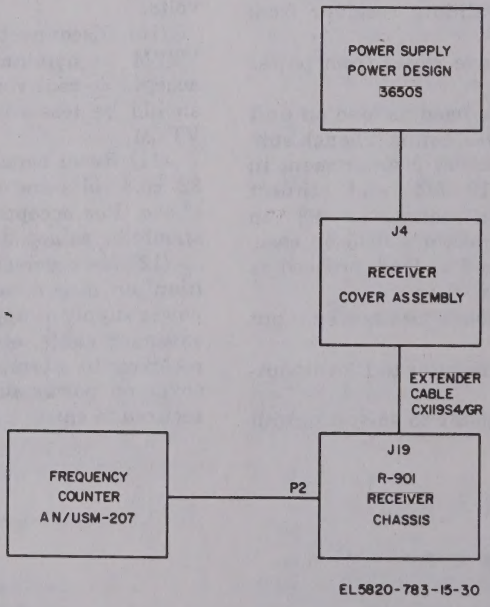

Fig. No. 10-2. Frequency Calibration Test Setup.

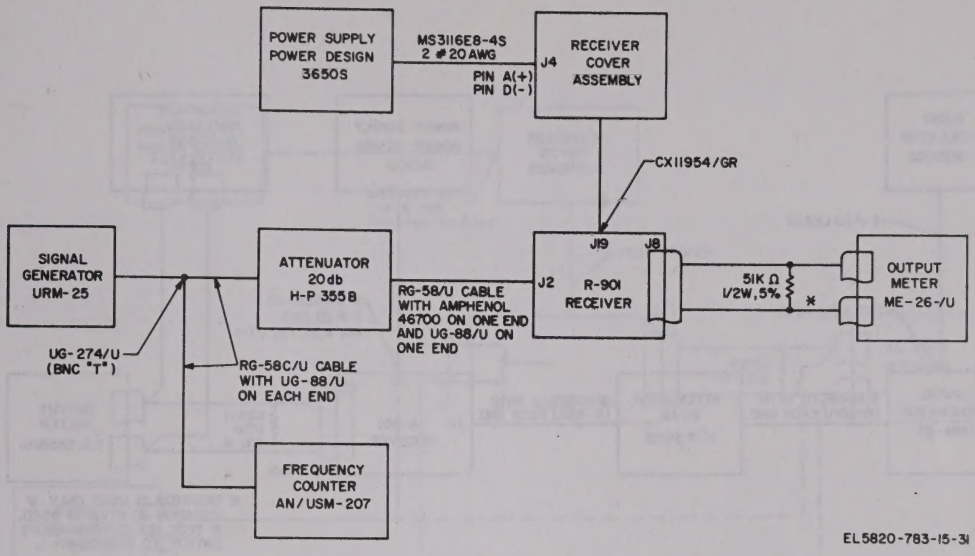

Fig. No. 10-3. Intermediate Frequency Test Setup.

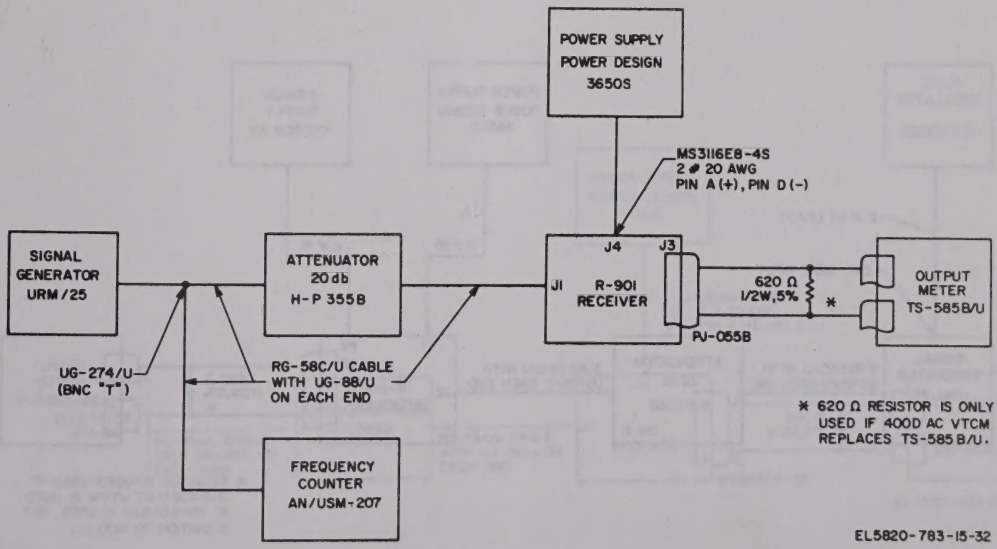

Fig. No. 10-4. AGC/AVC Characteristics Test Setup.

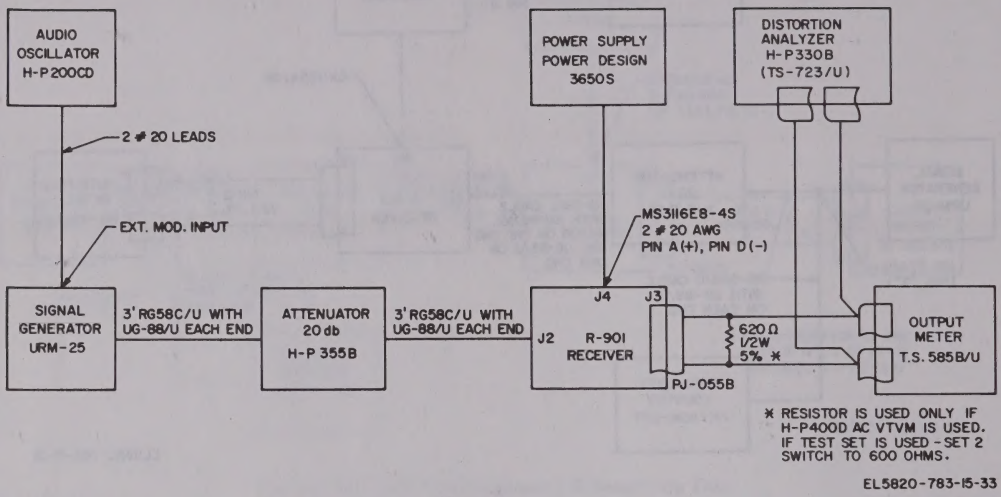
AUDIO OSCILLATOR H-P 200CD
2 # 20 LEADS
EXT. MOD. INPUT
SIGNAL GENERATOR URM-25
3' RG58C/U WITH UG-88/U EACH END
ATTENUATOR 20 db H-P 355B
3' RG58C/U WITH UG-88/U EACH END
POWER SUPPLY POWER DESIGN 3650S
MS3116E8-4S 2 # 20 AWG PIN A(+), PIN D(-)
J4
J3
J2
R-901 RECEIVER
PJ-055B
620 Ω 1/2W 5% *
DISTORTION ANALYZER H-P330B (TS-723/U)
OUTPUT METER T.S. 585B/U
* RESISTOR IS USED ONLY IF H-P400D AC VTVM IS USED. IF TEST SET IS USED - SET 2 SWITCH TO 600 OHMS.
EL5820-783-15-33

Fig. No. 10-5. Audio Output Power Level and Harmonic Distortion Test Setup.

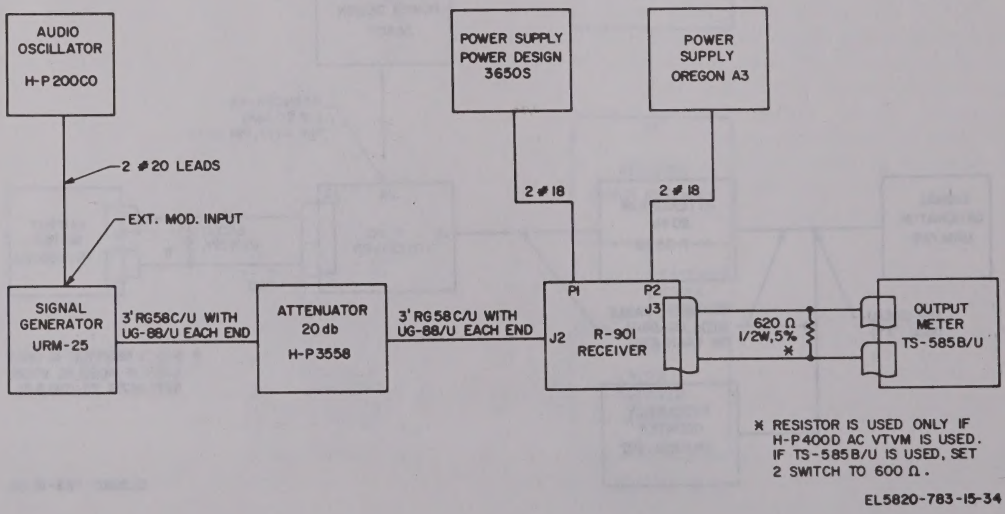
AUDIO OSCILLATOR H-P 200CO
2 # 20 LEADS
EXT. MOD. INPUT
SIGNAL GENERATOR URM-25
3' RG58C/U WITH UG-88/U EACH END
ATTENUATOR 20 db H-P 355B
3' RG58C/U WITH UG-88/U EACH END
POWER SUPPLY POWER DESIGN 3650S
POWER SUPPLY OREGON A3
2 # 18
2 # 18
P1
P2
J3
J2
R-901 RECEIVER
620 Ω 1/2W, 5% *
OUTPUT METER TS-585B/U
* RESISTOR IS USED ONLY IF H-P400D AC VTVM IS USED. IF TS-585B/U IS USED, SET 2 SWITCH TO 600 Ω.
EL5820-783-15-34

Figure. No. 10-6. Audio Output Level (Battery Operation) Test Setup.

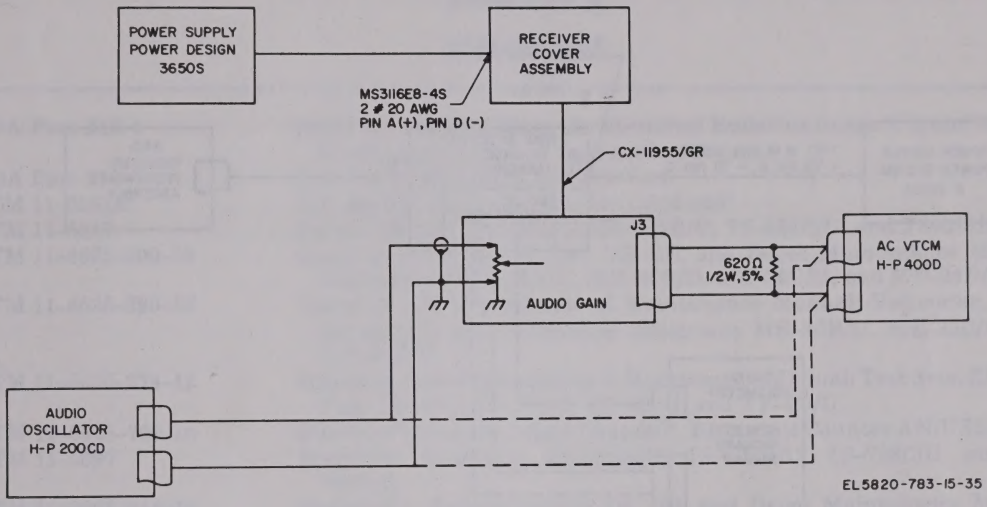

Fig. No. 10-7. Audio Response Test Setup.

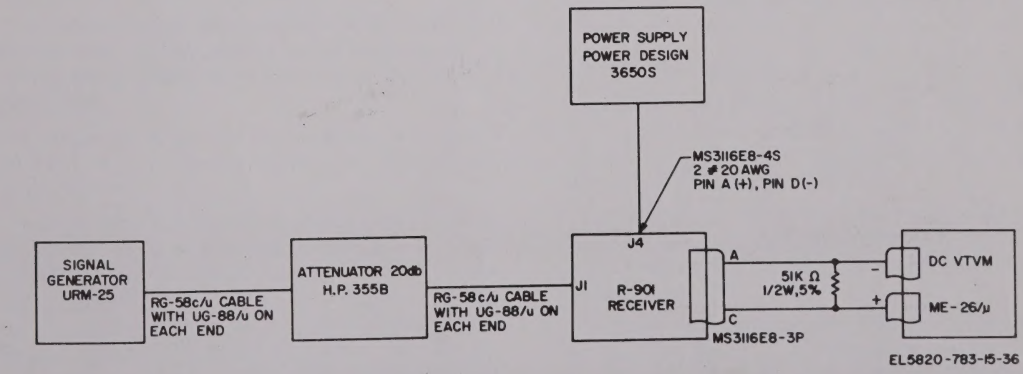

Fig. No. 10-8. Diode Output Test Setup.

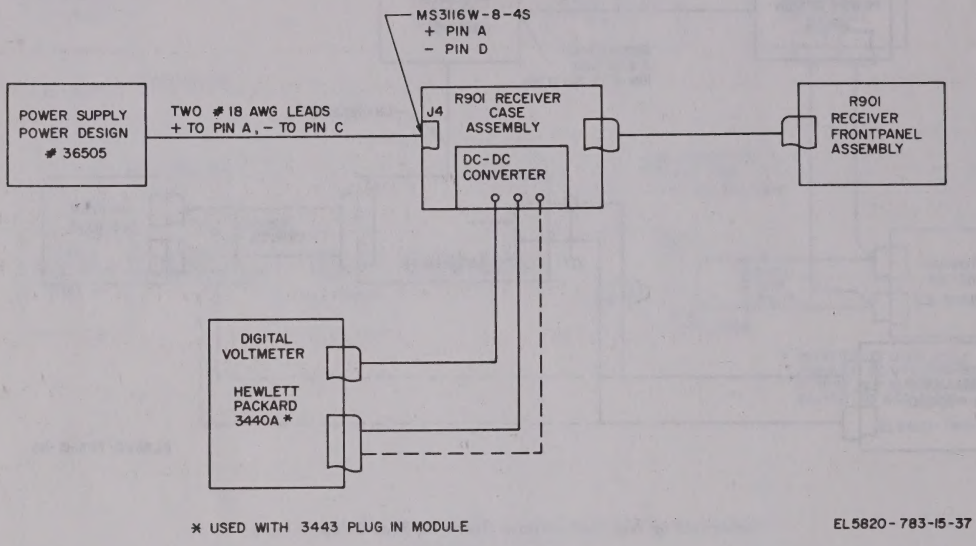

Fig. No. 10-9. DC—DC Converter Test Setup.

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	Index of Modification Work Orders.
TM 11-5551E	R.F. Signal Generator Set AN/URM-25F.
TM 11-5017	Output Meters TS-585A/U, TS-585B/U, TS-585C/U, and TS-585D/U.
TM 11-6625-200-15	Operator's, Organizational, DS, GS, and Depot Maintenance Manual: Multimeters ME-26A/U, ME-26B/U, ME-26C/U, and ME-26D/U.
TM 11-6625-320-12	Operator and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U, and Voltmeters Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM 11-6625-274-12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U.
TM 11-6625-700-10	Operator's Manual: Digital Readout, Electronic Counter AN/USM-207.
TM 11-5097	Spectrum Analyzers TS-723A/U, TS-723B/U, TS-723C/U, and TS-723D/U.
TM 11-6625-444-15	Operator's, Organizational, DS, GS, and Depot Maintenance Manual: Digital Voltmeter AN/GSM-64.

APPENDIX B
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

B-1. General

This appendix provides a summary of the maintenance operations for R-901/GR. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

B-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfuction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

B-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of

maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C—Operator/Crew
O—Organizational
F—Direct Support
H—General Support
D—Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

B-4. Tool and Test Equipment Requirements (sect III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

(Next printed page is 3.)

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO RECEIVER R-901/GR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
00	RECEIVER, RADIO R-901/GR	Inspect		0.5					
		Test			1.0			4,6,11	
		Adjust			1.0			11	
		Align				2.0		1 thru 7 11,13,14	
		Calibrate				2.0		1 thru 7 11,13,14	
		Replace		0.5				11	
		Repair				3.0		1 thru 14	
		Overhaul					20.0	1 thru 14	
01	RF TUNER	Replace				3.0		11	
		Repair				4.0		1,2,4,5, 6,8,11, 14	
		Overhaul					5.0	1,4,5,6, 7,8,14	
0101	FIRST RF AMPLIFIER A1	Replace			1.0			11	
		Repair				2.0		1,2,4, thru 11, 14	
		Overhaul					3.0	1,4, thru 8, 14	
0102	SECOND RF AMPLIFIER A2	Replace			1.0			11	
		Repair				2.0		1,4,5, thru 8, 11,14	
		Overhaul					3.0	1,4, thru 8, 14	
0103	MIXER STAGE A3	Replace			1.0			11	
		Repair				2.0		1,2,4, thru 8, 11,14	
		Overhaul					3.0	1,2,4,5, 6,8,14	
0104	LOCAL OSCILLATOR A4	Replace			1.0			11	
		Repair				2.0		1,2,4, thru 8, 11,14	
		Overhaul					3.0	1,2,4,5, 6,8,14	

SECTION II MAINTENANCE ALLOCATION CHART FOR RADIO RECEIVER R-901/GR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
02	IF AMPLIFIER A5	Replace			1.0			11	
		Repair				2.0		1,2,4,5, 6,8,11, 14	
		Overhaul					3.0	1 thru 9, 11,14	
03	IF AMPLIFIER OUTPUT A6	Replace			1.0			11	
		Repair				2.0		1,2,4,5, 6,11	
		Overhaul					3.0	1 thru 9, 11,14	
04	FREQUENCY OSCILLATOR A7	Replace			1.0			11	
		Repair				3.0		1,3,5,7, 8,11,14	
		Overhaul					3.0	1,3, thru 8, 14	
05	VAR. BEAT FREQUENCY OSCILLATOR A8	Replace			1.0			11	
		Repair				2.0		1 thru 6, 8,11,13, 14	
		Overhaul					3.0	1 thru 9, 13,14	
06	AUDIO FREQ. AMPLIFIER ASSEMBLY A9	Replace			1.0			11	
		Repair				2.0		1,2,4, thru 7, 14	
		Overhaul					3.0	1,2,4, thru 7, 14	
07	HARMONIC GENERATOR DIODE CR1 AND R14	Replace			1.0			11	
		Repair				2.0		2,4,11, 14	
08	POWER SUPPLY ASSEMBLY A10	Replace			1.0			11	
		Repair				2.0		3,4,5,6, 8,11	
		Overhaul					3.0	5,6,8,11	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
RADIO RECEIVER R-901/GR

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	F,H,D	SIGNAL GENERATOR, RF AN/URM-25	6625-00-775-1874	
2	F,H,D	MULTIMETER TS-585B/U	6625-00-244-0501	
3	F,H,D	COUNTER ELECTRICAL DIGITAL READOUT AN/USM-207	6625-00-911-6368	
4	F,H	MULTIMETER ME-26/U	6625-00-913-9781	
5	H,D	DIGITAL VOLTMETER AN/GSM-64	6625-00-870-2264	
6	F,H,D	VOLTMETER, ELECTRONIC ME-30(*)/U	6625-00-643-1670	
7	F,H,D	SPECTRUM ANALYZER TS-723/U	6625-00-668-9418	
8	F,H,D	TEST SET, ELECTRON TUBE TV-7D/U	6625-00-820-0064	
9	F,H,D	ATTENUATOR H-P 355B (20db)	6625-00-889-9052	
10	F	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/G	6625-00-879-4647 5180-00-605-0079	
11	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-105/G	5180-00-610-8177	
12	F,H,D	TOOL KIT, INTERCEPT EQUIPMENT TK-165/G	5180-00-762-9298	
13	F	SIGNAL GENERATOR AN/URM-127	6625-00-783-5965	
14	F,H,D	OSCILLOSCOPE AN/USM-281	6625-00-228-2201	

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